SUGARCANE RESEARCH

Annual Progress Report

1995

Louisiana State University
Agricultural Center
Louisiana Agricultural Experiment Station

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SUGARCANE RESEARCH

ANNUAL PROGRESS REPORT

1995

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LOUISIANA STATE UNIVERSITY AGRICULTURAL CENTER
H. ROUSE CAFFEY, CHANCELLOR

LOUISIANA AGRICULTURAL EXPERIMENT STATION
KENNETH W. TIPTON
VICE CHANCELLOR AND DIRECTOR

The Louisiana Agricultural Experiment Station provides equal opportunities in programs and employment.

FOREWORD

Research on sugarcane in the Louisiana Agricultural Experiment Station is an integral part of the LSU Agricultural Center's research-extension effort to provide the knowledge and technology base for efficient production and processing of sugarcane. Sugarcane research projects are led by scientists in the Sugar Station/Audubon Sugar Institute, and the departments of Agricultural Economics and Agribusiness, Agronomy, Biological and Agricultural Engineering, Entomology, and Plant Pathology and Crop Physiology.

Members of the Louisiana Agricultural Experiment Station maintain close working relations with colleagues in respective departments of the College of Agriculture and other colleges of the LSU Baton Rouge campus, the Louisiana Cooperative Extension Service, the Agricultural Research Service and Natural Resources Conservation Service of the USDA, the American Sugar Cane League, and the Louisiana Department of Agriculture and Forestry.

A major portion of the resources for production and processing research is linked to the St. Gabriel Research Station and Sugar Station/Audubon Sugar Institute respectively. The Iberia Research Station helped to accomplish specific sugarcane research objectives in 1995.

Important parts of the 1995 research effort were conducted on cooperating farms and in cooperating factories throughout the industry. These activities are very important and must be continued. **The cooperation of individual farms and sugarcane factories in conducting research projects and financial support of the American Sugar Cane League is gratefully acknowledged.**

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AN OVERVIEW OF THE LOUISIANA "L" SUGARCANE VARIETY DEVELOPMENT PROGRAM

F. A. Martin
Sugar Station/Audubon Sugar Institute

The primary objective of the Louisiana Agricultural Experiment Station Sugarcane Variety Development Program is to contribute to the profitability of the Louisiana sugarcane industry by breeding and developing improved sugarcane varieties.

Sugarcane breeding and variety development in the LAES are carried out by a team of scientists working under several CRIS projects. Although each member of the LAES Sugarcane Variety Development Team has a specific area of responsibility, each team member also has a general understanding of the entire program and often is called upon to assist in other areas of the program. Current team members (Table 1.) contribute expertise in the areas of agronomy, breeding, genetics, statistics, entomology, pathology, weed science, and physiology.

Table 1. Members of the LAES Sugarcane Breeding and Variety Development Team in 1995

Team Member	Budgetary Unit	Responsibility
F. A. Martin	Agronomy/Sugar Station/ASI	Program Leader
K. B. Bischoff	Agronomy	Selection
S. B. Milligan	Agronomy	Methodology/Genetics
H. P. Schexnayder, Jr.	St. Gabriel Station	Photoperiod & Crossing
P. H. Rodriguez	Agronomy	Variety Testing
G. L. Hawkins	Sugar Station/ASI	Sucrose Lab
H. P. Schexnayder	St. Gabriel Station	Farm Manager
H. P. Viator	Iberia Station	Variety Testing
K. L. Quebedeaux	Iberia Station	Variety Testing
T. E. Reagan	Entomology	Insect Resistance
J. W. Hoy	Plant Pathology & Crop Physiology	Disease Resistance
J. L. Griffin	Plant Pathology & Crop Physiology	Herbicide Tolerance

The LAES sugarcane breeding team and the USDA sugarcane breeding team work independently yet cooperatively to produce "L" and "HoCP" varieties, respectively. The best varieties from the two programs are brought together for evaluation at the "outfield test locations." Outfield testing is conducted by personnel of the Louisiana Agricultural Experiment Station, the United States Department of Agriculture, and the American Sugar Cane League in accordance to the provisions of the "Three-way Agreement of 1978." After yield data for one crop cycle (plant cane, first stubble, and second stubble) is collected in the outfield, those varieties that show promise are released for commercial production.

A total of 74,450 seedlings from 201 crosses were planted to the field in the spring

of 1995. The majority of the seedlings were from commercial varieties and elite experimental varieties. One hundred fifty-four of these crosses were included in a replicated progeny test.

Photoperiod treatments were begun in the end of May, and continued until the beginning of September. While stalks on the first carts to exit the photoperiod chambers had acceptable flowering, stalks on the first carts to enter the chamber and the middle carts flowered poorly. We reviewed procedures with the personnel who move the carts to identify the cause of the poor flowering. We speculate that frequent movement of plants into the chambers during the light treatment, to avoid damage from winds associated with thunderstorms, affected the flower initiation of those stalks on carts in the darkened area of the chambers.

We produced 272 crosses with the 447 tassels of 58 sugarcane varieties that flowered in 1995. Of the 310,334 viable seed produced, 268,455 were from 224 biparental crosses, 20,347 from polycrosses, and 21,532 from self pollination. The germination of seed from biparental crosses was good (average 144 viable seed per gram of fuzz). As expected, the highest germination was in the polycrosses (average 248 viable seed per gram of fuzz). Seed production in 1995 exceeded the requirements of the selection stage of the program.

In the fall of 1995, individual selection was practiced on 25,492 stubble seedlings that represented the top 54% of the 160 families available from the 1993 crossing series. Of the 25,492 clones in the selected families, 3,219 were selected and planted in the first-line trials.

Established procedures were used to advance superior phenotypes of the 1992 crossing series from first-line trials to second-line trials (650 clones), and of the 1991 crossing series from second-line trials to increase-trials (391 clones). After preliminary ratings for cane yield and plant type in August, clones with acceptable ratings are further evaluated for lodging, borer damage, presence of disease, presence of pith/tube, and brix/sucrose content.

The best 47 clones from the 1990 crossing series were assigned permanent variety identification in the fall of 1995. Newly assigned varieties were entered in replicated nursery trials at three locations. The exchange of "L" and "HoCP" varieties which was curtailed when leaf scald was discovered at Chacahoula in 1992, was resumed in 1995 after leaf scald was observed at the St. Gabriel Station in 1994.

Experimental varieties were replanted in infield and nursery tests (13), introduced to the outfield tests (16), and replanted in outfield tests (13). Breeding personnel assisted Dr. Jeff Hoy and Dr. T. E. Reagan to enter the experimental varieties in sugarcane smut (disease) and sugarcane borer (insect) resistance trials respectively. Only those experimental varieties that have outstanding attributes are placed in the outfield trials.

The distribution of "L" clones through stages of testing in 1995 is presented in Table 2. The practice of placing nursery trials (planted in years 5 & 6) at multiple locations allows us to more efficiently identify the superior varieties in each assignment series.

Table 2. Number of "L" clones by Series at most advanced stage of testing for the series in 1995.

Series	Stage of Testing	Year from seedling	Number of clones
L 1988	Outfield - Second Stubble	12	0
L 1989	Outfield - First Stubble	11	0
L 1990	Outfield - Plant Cane	10	0
L 1991	Outfield - Planted in outfield	9	0
L 1992	Outfield - Planted in outfield	8	6
L 1993	Outfield - Introduced	7	9
L 1994	Nursery - Plant Cane	6	23
L 1995	Assignment	5	47

More detailed information on each stage of the Louisiana Sugarcane Variety Development Program can be found in the reports that follow.

Progress in the "L" Sugarcane Breeding and Variety Development Program would not be possible without the support of the director of the Louisiana Agricultural Experiment Station and the financial support of the American Sugar Cane League.

1995 PHOTOPERIOD AND CROSSING IN THE LOUISIANA "L" SUGARCANE VARIETY DEVELOPMENT PROGRAM

H.P. Schexnayder, Jr., S. B. Milligan, and F. A. Martin
St. Gabriel Research Station, Agronomy Department, and Sugar Station

The primary objective of the photoperiod and crossing stage of the Louisiana "L" Sugarcane Variety Development Program is to produce sufficient quantities of viable seed from the most desirable crosses. Success of the overall program is very dependent upon success at this first stage.

Cuttings of potential parent varieties started in the fall of 1994 were fertilized weekly with a 200 ppm solution of Peter's 20-20-20, until the resulting plants were transferred to can culture in late January 1995 and top dressed with a slow release fertilizer (Slo-cote 21-7-11, 50 g/can). In April the cans were moved from the greenhouse to the photoperiod rail carts and weekly soluble fertilizer applications were resumed. Fertilization was discontinued in early May to condition the plants for floral induction. Two additional applications of dry granular fertilizer, without nitrogen, (Mixture of Potash 0-0-60 and Triple Superphosphate 0-45-0, one tbls/can) were applied to the cans during July and August.

Natural lighting and six light tight chambers (photoperiod bays) were used to impose photoperiod treatments. To prevent overwhelming crossing facilities, two flowering peaks were planned for September 25 and October 9 (Table 1). Records of varietal flowering and pollen production were used to determine the most appropriate photoperiod treatment for each variety. Poor flowering varieties or those varieties with no flowering history were generally scheduled within the late peak and the longest inductive treatments (bays 5 & 6). Varieties scheduled for use as males were placed in center bays 3 and 4. Easier to flower varieties were generally placed in bays 1 through 3 with some cans placed in bays 4 through 6. Material on photoperiod bay 2 consisted mostly of easily flowering female varieties (Table 1). The first photoperiod treatments were begun on May 30. All photoperiod treatments began with consecutive days of 12½ h photoperiod, with the exception of Bay 5, Cart C which had 12¼ h photoperiod (Table 1). During July the reduction of day length by 1 min d^{-1} was begun. Treatments differed by the number of days with constant day length and the date on which the decline of photoperiod was initiated. All photoperiod treatments were discontinued on September 10, 1995, when natural day length was 12½ hours. Besides the normal photoperiod treatments, two experiments started in 1994 were continued in 1995. One experiment addressed the effects of cool mist (triggered by a temperature threshold) on flower induction of certain hard-to-induce varieties. The second experiment compared the effect of a shorter initial constant photoperiod on flowering.

Both tasseling percentage and synchronization of tasseling were poor in 1995 (Tables 1-3). Percent flowering on carts B and C (first cart to enter photoperiod bay) was very poor (Table 1). We reviewed procedures with personnel who move the carts to identify the cause of the poor flowering. Our procedures include moving carts into the chambers when a strong thunderstorm approaches the facilities. With carts inside the chambers, the doors are left open. During the 1995 photoperiod treatment period, inexperienced personnel moved carts into the chambers whenever thunderheads were visible in the area. We speculate that the frequent

movement of plants into the chambers during the light treatment affected the flower initiation of those stalks on carts in the interior (darkened area) of the chambers.

Crossing began on September 11 and ended on November 10, 1995. Four hundred forty-seven tassels of 58 varieties were used to produce 272 total crosses yielding 310,000 viable seed with over 268,000 from 224 biparental crosses (Table 4). The germination of seed from biparental crosses was good (average 144 viable seed per gram fuzz). Seed production in 1995 exceeded the requirements of the selection stage of the program. The material in the crossing greenhouse (rails 7 & 8) was used to make the first approximation of the flowering characteristics of new varieties by comparing the date of tasseling of new varieties to those of known varieties (Tables 5 and 6). Varietal flowering dates were recorded from December 3, 1995, through January 6, 1996. At that time, all varieties that had not tasseled were examined for signs of induction. Tassels from greenhouse were not used for crossing.

Data of the crosses and seed produced sorted by cross number, female parent, and male parent are presented in tables 7 through 9 respectively.

Table 1. Summary of 1995 photoperiod treatments†.

Bay	Cart	Earliest Start Treatment	Days of Constant Photoperiod	Date Photoperiod Decline Began	Days of Declining Photoperiod		Mean Flower Date	Total Stalks	Percent Flowered
					Peak1	Peak2			
1	A	May 30	38	July 7	80	95	Oct. 3 ± 16	86	63
1	B	May 30	38	July 7	80	95	Oct. 9 ± 18	86	23
1	C	May 30	38	July 7	80	95	Oct. 10 ± 5	85	5
2	A	June 7	34	July 11	76	90	Oct. 7 ± 15	89	62
2	B	June 7	34	July 11	76	90	Oct. 10 ± 21	87	11
2	C	June 7	34	July 11	76	90	Oct. 11 ± 3	79	3
3	A	June 7	35	July 11	70	85	Sept 29 ± 16	86	70
3	B	June 12	35	July 11	70	85	Oct. 6 ± 15	76	38
3	C	June 12	35	July 11	70	85	Oct. 22 ± 12	73	7
4	A	June 26	35	July 31	55	70	Oct. 13 ± 12	84	68
4	B	June 26	35	July 31	55	70	Oct. 21 ± 11	83	36
4	C	June 26	35	July 31	55	70	Oct. 15 ± 14	69	29
5	A	June 18	34	July 22	65	79	Oct. 14 ± 21	77	52
5	B	June 18	34	July 22	65	79	Oct. 23 ± 12	86	19
5	C	June 18	34	July 22	65	79	--------	83	0
6	A	May 30	42	July 11	75	90	Oct. 7 ± 15	89	31
6	B	May 30	42	July 11	75	90	Oct. 13 ± 15	86	13
6	C	May 30	42	July 11	75	90	Oct. 2 ± 15	81	7

† Decline rate = 1 min d^{-1}; all bays were heated; all bays were exposed to photoperiods = 12.5 h d^{-1} except bay-cart 5A which = 12.25 h d^{-1}.

Table 2. Varietal flowering summary by 1995 photoperiod treatment.

Variety	Peak	Days to First Flower£	Mean Days to Flower	Mean Pollen Rating¥	Total # stalks	Percent flowered
CP65-357	Early	115	133.0	9.0	5	60
CP65-357	Late	107	108.5	9.0	4	100
CP70-321	Late	150	150.0	7.0	20	50
CP70-330	Early	115	124.3	5.0	11	55
CP70-330	Late	133	133.0	5.0	5	40
CP72-370	Early	None§	.	.	9	0
CP72-370	Late	143	143.0	5.0	19	5
CP76-301	Late	None	.	.	12	0
CP76-331	Early	None	.	.	7	0
CP76-331	Late	134	139.4	3.0	15	33
CP77-310	Early	None	.	.	18	0
CP77-407	Early	Indc	.	.	1	0
CP77-407	Late	Emgd	.	.	1	0
CP78-304	Early	None	.	.	9	0
CP78-317	Early	95	103.3	6.3	6	67
CP78-317	Late	94	100.9	4.3	15	100
CP79-318	Early	124	126.0	1.0	10	20
CP79-318	Late	92	96.6	4.9	15	53
CP79-348	Early	None	.	.	7	0
CP79-348	Late	None	.	.	20	0
CP80-323	Early	None	.	.	12	0
CP80-323	Late	None	.	.	5	0
CP82-551	Late	None	.	.	21	0
CP83-644	Late	148	148.0	3.0	21	10
CP84-730	Late	None	.	.	17	0
CP84-772	Early	114	114.0	3.0	5	20
CP84-772	Late	None	.	.	3	0
CP87-625	Early	107	114.2	8.4	14	71
CP87-625	Late	120	120.0	9.0	5	20
HoCP85-845	Early	105	121.6	4.2	29	62
HoCP85-845	Late	111	125.1	4.2	28	50
HoCP88-739	Early	131	131.0	9.0	8	13
HoCP88-739	Late	Indc	.	.	2	0
HoCP89-843	Early	None	.	.	2	0
HoCP89-843	Late	None	.	.	9	0
HoCP89-846	Early	112	121.8	7.0	17	53
HoCP89-846	Late	102	109.8	7.8	29	62
HoCP90-923	Early	140	142.5	6.0	8	25
HoCP90-923	Late	137	137.0	5.0	11	9
HoCP90-941	Late	94	100.5	4.5	26	65
HoCP90-957	Early	120	126.2	7.0	13	77
HoCP90-957	Early	None	.	.	3	0
HoCP90-957	Late	119	126.0	7.5	10	40
HoCP90-963	Early	116	121.5	5.1	26	58
HoCP90-963	Late	127	131.7	7.3	4	75
HoCP91-527	Early	134	148.0	4.0	11	18
HoCP91-527	Late	None	.	.	11	0
HoCP91-552	Late	102	108.8	2.5	13	100
HoCP91-555	Early	None	.	.	9	0
HoCP91-555	Late	None	.	.	9	0

Table 2 Continued

Variety	Peak	Days to First Flower£	Mean Days to Flower	Mean Pollen Rating¥	Total # stalks	Percent flowered
HoCP91-559	Early	107	126.5	4.0	5	80
HoCP92-618	Late	127	127.0	3.0	6	17
HoCP92-624	Late	101	110.7	5.9	9	78
HoCP92-629	Late	115	115.0	9.0	4	25
HoCP92-644	Late	None	.	.	4	0
HoCP92-648	Early	None	.	.	5	0
HoCP92-654	Early	114	134.0	6.5	4	50
HoCP92-664	Early	None	.	.	8	0
HoCP92-674	Early	124	131.8	3.0	6	67
HoCP92-674	Late	None	.	.	5	0
HoCP92-675	Early	95	98.8	3.0	9	67
HoCP92-676	Early	None	.	.	6	0
HoCP92-678	Late	None	.	.	3	0
HoCP93-775	Late	None	.	.	4	0
Ho89-889	Early	139	142.5	7.0	31	6
Ho89-889	Late	None	.	.	4	0
Ho91-566	Early	None	.	.	5	0
Ho91-566	Late	None	.	.	5	0
Ho93-768	Early	None	.	.	6	0
Ho93-769	Early	150	150.0	3.0	5	20
Ho93-773	Early	None	.	.	5	0
Ho93-774	Early	None	.	.	6	0
LCP81-010	Early	None	.	.	8	0
LCP81-010	Late	110	120.3	3.7	17	18
LCP81-030	Early	None	.	.	8	0
LCP81-030	Late	106	107.9	1.3	16	44
LCP82-089	Early	129	0.0	1.0	12	8
LCP82-089	Late	120	133.1	2.2	18	72
LCP83-137	Late	134	142.2	7.7	19	32
LCP85-313	Early	105	115.0	8.5	11	73
LCP85-313	Late	109	121.4	8.5	18	89
LCP85-336	Early	129	137.2	2.6	15	33
LCP85-336	Late	155	155.0	3.0	5	20
LCP85-341	Early	123	123.0	5.0	3	33
LCP85-341	Late	112	115.8	6.0	15	27
LCP85-371	Late	98	102.5	4.0	6	100
LCP85-384	Early	112	133.5	2.0	28	14
LCP85-384	Late	Emgd	.	.	1	0
LCP86-422	Early	None	.	.	9	0
LCP86-422	Late	None	.	.	10	0
LCP86-429	Early	102	104.5	9.0	3	67
LCP86-429	Late	102	113.8	9.0	14	86
LCP86-450	Early	None	.	.	4	0
LCP86-454	Early	None	.	.	3	0
LCP86-454	Late	102	102.0	5.0	13	8
LHo83-153	Late	None	.	.	17	0
LHo92-307	Early	None	.	.	6	0
LHo92-307	Late	None	.	.	10	0
LHo92-314	Early	112	116.5	1.0	6	33
LHo92-314	Late	130	130.0	3.0	6	17

Table 2 Continued

Variety	Peak	Days to First Flower£	Mean Days to Flower	Mean Pollen Rating¥	Total # stalks	Percent flowered
L84-290	Early	Boot	.	.	1	0
L89-113	Early	None	.	.	11	0
L89-113	Late	124	133.5	8.0	20	10
L92-312	Early	105	113.7	1.9	17	65
L92-312	Late	120	132.3	2.0	12	50
L92-313	Early	114	122.2	8.2	11	45
L92-313	Late	None	.	.	12	0
L92-315	Early	None	.	.	4	0
L92-315	Late	None	.	.	4	0
L92-319	Early	None	.	.	5	0
L92-319	Late	None	.	.	3	0
L92-321	Early	105	117.0	2.0	16	38
L92-321	Late	109	109.0	3.0	4	25
L92-355	Early	153	153.0	1.0	17	6
L92-355	Late	None	.	.	7	0
L93-358	Early	Indc	.	.	2	0
L93-363	Late	109	109.0	3.0	7	71
L93-365	Early	125	134.4	3.0	10	50
L93-366	Late	105	123.8	8.6	6	83
L93-371	Early	164	164.0	5.0	5	20
L93-374	Late	None	.	.	5	0
L93-376	Early	150	150.0	9.0	6	17
L93-378	Early	None	.	.	6	0
L93-378	Late	None	.	.	4	0
L93-380	Late	112	117.5	3.0	5	80
L93-382	Early	None	.	.	5	0
L93-382	Late	None	.	.	4	0
L93-385	Late	None	.	.	5	0
L93-386	Late	137	137.0	3.0	9	22
L93-387	Late	None	.	.	4	0
L93-388	Early	None	.	.	5	0
L93-391	Early	112	113.8	1.4	6	83
L93-393	Late	138	138.0	5.0	3	33
L93-394	Late	None	.	.	6	0
L93-395	Late	137	137.0	5.0	4	25
L93-397	Early	None	.	.	5	0
L93-397	Late	None	.	.	4	0
L93-399	Early	118	139.6	7.7	10	90
L93-401	Early	None	.	.	4	0
L93-402	Early	None	.	.	3	0
L95-448	Early	None	.	.	4	0
US77-010	Early	None	.	.	10	0
US77-010	Late	101	104.0	1.0	17	41
US77-017	Early	None	.	.	9	0
US77-017	Late	136	140.0	3.0	21	33
US78-020	Late	118	125.3	1.5	11	36

£ Days to first flower is calculated as the number of days from the initiation of photoperiod treatments until the first flower of a variety-treatment combination.

¥ Pollen rating is visually assigned where 1=much pollen to 9=no pollen.

§ Abrt - aborted; Boot - boot stage; Emgd - emerged; Indc - induced; None - no flowering response.

Table 3. Summary of can, variety, and flower information on Bays 1 - 6 subjected to photoperiod treatments.

Varieties used in crossing	Cans with stalks	Cans with tassels	Total stalks	Total tassels	Mean stalks per can	Mean tassels per can†	Mean pollen rating	Mean flowering date
	number						unitless	days
58	324	150	1485	447	4.58 ±0.98	2.98 ±1.55	5.29 ±3.23	Oct. 6 ±17.1

† Based upon cans with tassels.

Table 4. Summary of 1995 crossing and seed production activities.

Type of cross	Crosses	Sum of seed production	Mean seed production per cross	Mean seed production per female tassel	Mean germination per gram seed
	number				
Biparenal	224	268,455	1198 ±1346	1063 ±1108	144 ±127
Polycross	10	20,347	2035 ±1467	2035 ±1467	248 ±142
Self	38	21,532	567 ±1065	389 ±754	53 ±90
Total	272	310,334	1141 ±1340	1005 ±1120	135 ±128

Table 5. Summary of can, variety, and flower information on Bays 7 & 8 under natural photoperiod conditions.

Total Cans	Cans Used	Total Varieties Known†	Total Varieties Unknown‡	Varieties Flowering Known	Varieties Flowering Unknown	Mean Stalks Per Can	Mean Tassels Per Can £
number						number/can	
108	108	4	76	3	32	4.74	2.62

† Flowering ability is known.
‡ Flowering ability is unknown.
£ Based upon cans with tassels.

Table 6. Summary of varietal responses to natural photoperiod in 1995.

Variety	First Flower Date£	Mean Flower Date£	Mean Pollen Rating¥	Number of Tassels
CP72-370*	Indc§	.	.	.
CP77-310*	340	352.9	4.2	12
CP78-317*	335	335.7	4.0	4
HoCP92-614	351	352.5	4.0	3
HoCP92-657	348	348.0	9.0	1
HoCP93-701	Abrt	.	.	.
HoCP93-703	Boot	.	.	.
HoCP93-706	Indc	.	.	.
HoCP93-708	351	358.5	4.5	2
HoCP93-709	Indc	.	.	.
HoCP93-715	Abrt	.	.	.
HoCP93-719	None	.	.	.
HoCP93-724	368	368.0	4.0	1
HoCP93-725	346	355.0	7.0	4
HoCP93-727	361	362.5	4.5	2
HoCP93-728	None			
HoCP93-729	None	.	.	.
HoCP93-731	Indc	.	.	.
HoCP93-739	Indc	.	.	.
HoCP93-742	342	344.5	4.5	3
HoCP93-743	None	.	.	.
HoCP93-744	Abrt	.	.	.
HoCP93-746	Indc	.	.	.
HoCP93-749	366	367.5	7.0	3
HoCP93-750	Indc	.	.	.
HoCP93-752	None	.	.	.
HoCP93-753	351	355.0	4.7	3
HoCP93-754	None	.	.	.
HoCP93-755	352	358.5	6.0	2
HoCP93-757	341	351.3	7.7	3
HoCP93-760	Emgd	.	.	.
HoCP93-763	Abrt	.	.	.
HoCP93-766	Abrt	.	.	.
HoCP93-767	Indc	.	.	.
L94-403	342	347.0	9.0	6
L94-404	355	358.3	8.3	3
L94-405	Boot	.	.	.
L94-406	Indc	.	.	.
L94-407	348	349.8	5.3	7
L94-408	358	361.5	3.0	3
L94-409	None	.	.	.
L94-410	None	.	.	.
L94-411	Abrt	.	.	.
L94-412	None	.	.	.
L94-413	352	358.0	7.7	4

Table 6 Continued

Variety	First Flower Date	Mean Flower Date	Mean Pollen Rating	Number of Tassels
L94-414	None	.	.	.
L94-415	None	.	.	.
L94-416	None	.	.	.
L94-420	351	354.0	5.3	4
L94-421	366	368.5	5.0	5
L94-422	340	343.3	3.3	3
L94-423	Boot	.	.	.
L94-424	None	.	.	.
L94-425	None	.	.	.
L94-426	348	349.5	4.0	4
L94-427	Abrt	.	.	.
L94-428	353	353.0	5.0	1
L94-429	345	346.0	4.0	3
L94-430	Abrt	.	.	.
L94-431	Indc	.	.	.
L94-432	None	.	.	.
L94-433	347	347.0	7.0	1
L94-434	None	.	.	.
L94-435	369	369.0	7.0	2
L94-436	351	351.0	1.0	3
L94-437	360	360.0	7.0	1
L94-438	Indc	.	.	.
L94-439	346	348.5	3.0	3
L94-440	None	.	.	.
L94-441	349	349.0	4.0	1
L94-442	Boot	.	.	.
L94-443	Abrt	.	.	.
L94-444	344	350.0	7.0	2
L94-445	344	344.0	4.0	1
L94-446	None	.	.	.
L94-447	359	362.0	4.7	3
*LCP85-384	345	354.3	2.7	17

£ Julian date.

¥ Pollen rating is visually assigned where 1=much pollen to 9=no pollen.

§ Abrt - aborted; Boot - boot stage; Emgd - emerged; Indc - induced; None - no flowering response.

* Varieties used for reference.

Table 7. Cross and seed made in 1995 sorted by cross number.

Cross	Female	Male	Seed	Cross	Female	Male	Seed
XL95-001	CP78-317	HoCP92-675	36	XL95-052	HoCP89-846	LCP82-089	2772
XL95-002	HoCP92-675	HoCP92-675	769	XL95-053	HoCP92-624	LCP82-089	2252
XL95-003	HoCP91-559	HoCP92-675	30	XL95-054	L91-281	LCP82-089	2986
XL95-004	CP87-625	HoCP92-675	95	XL95-055	LCP82-089	LCP82-089	3737
XL95-005	CP87-625	HoCP90-941	0	XL95-056	HoCP90-941	L92-312	424
XL95-006	CP78-317	HoCP90-941	0	XL95-057	CP79-318	L92-312	171
XL95-007	HoCP90-941	HoCP90-941	0	XL95-058	HoCP89-846	L93-391	1307
XL95-008	HoCP90-941	CP78-317	24	XL95-059	HoCP90-957	L93-391	531
XL95-009	CP78-317	CP78-317	0	XL95-060	HoCP90-963	L93-391	259
XL95-010	CP87-625	L92-321	19	XL95-061	CP87-625	L93-391	236
XL95-011	L92-321	L92-321	97	XL95-062	L93-391	L93-391	220
XL95-012	CP87-625	HoCP85-845	0	XL95-063	HoCP89-846	HoCP91-559	673
XL95-013	HoCP85-845	HoCP85-845	16	XL95-064	HoCP90-957	HoCP91-559	83
XL95-014	HoCP85-845	L92-321	926	XL95-065	HoCP89-846	US77-010	1337
XL95-015	CP79-318	L92-312	1122	XL95-066	HoCP90-957	US77-010	1338
XL95-016	HoCP85-845	L92-312	1120	XL95-067	CP79-318	US77-010	2294
XL95-017	L92-312	L92-312	359	XL95-068	US77-010	US77-010	793
XL95-018	HoCP85-845	CP79-318	4380	XL95-069	HoCP89-846	HoCP90-963	12
XL95-019	CP79-318	CP79-318	570	XL95-070	L91-281	HoCP90-963	88
XL95-020	LCP86-429	L92-312	1987	XL95-071	HoCP85-845	HoCP90-963	212
XL95-021	L91-281	L92-312	984	XL95-072	HoCP90-963	HoCP90-963	0
XL95-022	LCP86-429	CP79-318	2591	XL95-073	HoCP92-624	LCP82-089	1771
XL95-023	LCP85-313	CP79-318	1568	XL95-074	CP70-330	LCP82-089	888
XL95-024	CP65-357	HoCP91-559	225	XL95-075	CP65-357	LCP82-089	2303
XL95-025	HoCP92-629	HoCP91-559	59	XL95-076	CP65-357	L93-391	815
XL95-026	L91-281	HoCP91-559	171	XL95-077	HoCP90-963	L93-391	96
XL95-027	HoCP91-559	HoCP91-559	58	XL95-078	LCP85-313	L93-391	1950
XL95-028	LCP86-429	CP70-330	59	XL95-079	HoCP90-963	US77-010	50
XL95-029	CP87-625	CP70-330	0	XL95-080	L91-281	US77-010	2238
XL95-030	CP70-330	CP70-330	0	XL95-081	HoCP90-963	US78-020	64
XL95-031	HoCP89-846	LCP86-454	466	XL95-082	HoCP85-845	US78-020	609
XL95-032	L91-281	LCP86-454	1080	XL95-083	L93-399	US78-020	595
XL95-033	LCP85-313	LCP86-454	870	XL95-084	CP65-357	HoCP90-941	161
XL95-034	LCP86-454	LCP86-454	205	XL95-085	HoCP89-846	HoCP90-941	13
XL95-035	L91-281	CP70-330	630	XL95-086	HoCP85-845	HoCP90-941	66
XL95-036	HoCP85-845	CP70-330	162	XL95-087	CP65-357	HoCP92-654	63
XL95-037	L91-281	L92-312	2265	XL95-088	L92-313	HoCP92-654	154
XL95-038	HoCP90-963	L92-312	89	XL95-089	HoCP89-846	HoCP92-654	223
XL95-039	LCP86-429	L92-312	1394	XL95-090	HoCP92-654	HoCP92-654	747
XL95-040	L93-399	HoCP85-845	1338	XL95-091	HoCP89-846	HoCP92-675	584
XL95-041	L91-281	HoCP85-845	2480	XL95-092	LCP85-313	HoCP92-675	77
XL95-042	HoCP90-963	HoCP85-845	193	XL95-093	CP87-625	HoCP92-675	15
XL95-043	L91-281	L92-321	2865	XL95-094	HoCP90-957	LCP81-030	812
XL95-044	L91-281	CP79-318	589	XL95-095	HoCP91-559	LCP81-030	878
XL95-045	L91-281	US78-020	3790	XL95-096	HoCP89-846	LCP81-030	766
XL95-046	US78-020	US78-020	24	XL95-097	LCP85-313	LCP81-030	452
XL95-047	L91-281	LCP85-384	366	XL95-098	LCP81-030	LCP81-030	96
XL95-048	HoCP89-846	LCP85-384	43	XL95-099	HoCP85-845	US77-010	2208
XL95-049	LCP86-429	LCP85-384	294	XL95-100	CP87-625	US77-010	211
XL95-050	LCP85-384	LCP85-384	29	XL95-101	HoCP90-957	LCP82-089	1020
XL95-051	CP65-357	LCP82-089	1115	XL95-102	HoCP90-941	LCP82-089	1618

Table 7. continued.

Cross	Female	Male	Seed
XL95-103	LCP85-341	LCP82-089	750
XL95-104	CP70-330	L92-312	287
XL95-105	LCP85-341	L92-312	586
XL95-106	LCP85-371	L92-312	881
XL95-107	HoCP90-957	L93-365	92
XL95-108	HoCP90-941	L93-365	100
XL95-109	HoCP89-846	L93-365	179
XL95-110	L93-365	L93-365	45
XL95-111	HoCP90-957	LHo92-314	390
XL95-112	HoCP89-846	LHo92-314	1325
XL95-113	LHo92-314	LHo92-314	49
XL95-114	HoCP90-941	L93-391	1166
XL95-115	HoCP85-845	L93-391	1112
XL95-116	HoCP85-845	CP78-317	869
XL95-117	HoCP89-846	CP78-317	371
XL95-118	HoCP85-845	CP84-772	348
XL95-119	LCP85-313	CP84-772	29
XL95-120	HoCP90-963	CP84-772	35
XL95-121	CP84-772	CP84-772	154
XL95-122	HoCP85-845	LCP81-030	2216
XL95-123	HoCP90-963	LCP81-030	86
XL95-124	CP78-317	LCP81-030	311
XL95-125	LCP85-371	LCP81-030	0
XL95-126	LCP85-313	L92-312	0
XL95-127	HoCP90-957	L92-312	0
XL95-128	LCP81-010	LCP81-030	6039
XL95-129	L92-313	LCP81-030	855
XL95-130	HoCP89-846	L92-310	0
XL95-131	HoCP90-963	L92-310	167
XL95-132	L92-310	L92-310	298
XL95-133	HoCP89-846	HoCP91-552	2579
XL95-134	L92-313	HoCP91-552	1174
XL95-135	LCP85-313	HoCP91-552	1752
XL95-136	HoCP91-552	HoCP91-552	3973
XL95-137	LCP85-313	LCP85-336	0
XL95-138	LCP85-336	LCP85-336	4182
XL95-139	HoCP90-963	LCP82-089	481
XL95-140	HoCP91-559	L93-365	337
XL95-141	LCP85-313	L93-365	392
XL95-142	L92-313	L93-365	0
XL95-143	HoCP90-957	L92-310	1735
XL95-144	L91-281	L92-321	6347
XL95-145	HoCP85-845	L92-321	2016
XL95-146	HoCP85-845	LCP85-371	1280
XL95-147	LCP85-371	LCP85-371	113
XL95-148	CP87-625	HoCP91-552	329
XL95-149	HoCP85-845	HoCP91-552	5655
XL95-150	L93-366	HoCP91-552	301
XL95-151	L91-281	HoCP91-552	2913
XL95-152	HoCP90-963	CP78-317	202
XL95-153	L93-399	CP78-317	460
XL95-154	HoCP92-624	LCP82-089	4021
XL95-155	L91-281	LCP81-030	2552
XL95-156	L93-399	LCP81-030	2175
XL95-157	HoCP85-845	HoCP92-674	702
XL95-158	L91-281	HoCP92-674	4265
XL95-159	HoCP90-957	HoCP92-674	1531
XL95-160	HoCP92-674	HoCP92-674	108
XL95-161	L91-281	L92-312	1313
XL95-162	HoCP85-845	HoCP91-527	1168
XL95-163	HoCP91-527	HoCP91-527	53
XL95-164	L91-281	LCP82-089	6222
XL95-165	L91-281	LCP85-336	4391
XL95-166	L91-281	LHo92-314	579
XL95-167	L91-281	L93-365	1958
XL95-168	L91-281	LCP85-371	1910
XL95-169	L91-281	HoCP91-552	3067
XL95-170	LCP83-137	HoCP91-552	2366
XL95-171	L93-399	HoCP91-552	1308
XL95-172	HoCP90-941	HoCP92-674	549
XL95-173	LCP86-429	HoCP91-552	271
XL95-174	L91-281	CP78-317	813
XL95-175	LCP83-137	L92-321	1543
XL95-176	L91-281	LCP81-010	2668
XL95-177	LCP81-010	LCP81-010	1470
XL95-178	L91-281	CP79-318	1318
XL95-179	HoCP85-845	CP79-318	908
XL95-180	L91-281	HoCP92-624	726
XL95-181	LCP86-429	HoCP92-624	236
XL95-182	HoCP89-846	HoCP92-624	274
XL95-183	LCP83-137	HoCP92-624	831
XL95-184	HoCP92-624	HoCP92-624	279
XL95-185	HoCP89-846	L93-363	1220
XL95-186	HoCP90-963	L93-363	147
XL95-187	HoCP90-941	L93-363	758
XL95-188	L93-363	L93-363	133
XL95-189	LCP82-089	95P1	0
XL95-190	LCP85-341	95P1	1377
XL95-191	L93-363	95P1	1441
XL95-192	HoCP85-845	95P1	1461
XL95-193	LCP86-429	LCP85-384	0
XL95-194	HoCP88-739	LCP85-384	618
XL95-195	HoCP89-846	LCP85-336	1020
XL95-196	L93-380	LCP85-336	947
XL95-197	HoCP89-846	US78-020	3282
XL95-198	HoCP90-957	US78-020	350
XL95-199	CP87-625	L92-312	696
XL95-200	Ho89-889	L92-312	6547

Table 7. continued.

Cross	Female	Male	Seed	Cross	Female	Male	Seed
XL95-201	LCP83-137	CP83-644	1709	XL95-238	LCP85-313	L92-355	407
XL95-202	L89-113	CP83-644	1766	XL95-239	LCP86-429	L92-355	126
XL95-203	CP83-644	CP83-644	988	XL95-240	L92-355	L92-355	0
XL95-204	HoCP89-846	HoCP92-654	1326	XL95-241	HoCP90-957	LCP81-010	845
XL95-205	LCP85-313	LCP85-384	367	XL95-242	LCP85-313	CP76-331	451
XL95-206	HoCP90-963	LCP85-384	310	XL95-243	HoCP90-923	CP76-331	1086
XL95-207	HoCP89-846	HoCP92-674	2757	XL95-244	CP76-331	CP76-331	942
XL95-208	L89-113	L93-380	342	XL95-245	L92-312	95P2	2663
XL95-209	L93-380	L93-380	331	XL95-246	HoCP91-552	95P2	596
XL95-210	CP70-330	L93-380	1435	XL95-247	HoCP85-845	95P2	5258
XL95-211	L93-399	LCP85-336	2462	XL95-248	LCP86-429	CP76-331	827
XL95-212	HoCP90-963	LCP85-336	2763	XL95-249	LCP83-137	CP76-331	1479
XL95-213	HoCP90-941	L92-312	640	XL95-250	L93-399	L92-312	2933
XL95-214	CP70-330	L92-312	2006	XL95-251	L93-399	LCP82-089	2982
XL95-215	LCP85-313	L92-321	1200	XL95-252	HoCP90-957	HoCP91-559	567
XL95-216	HoCP89-846	L92-321	1584	XL95-253	L93-366	HoCP91-559	128
XL95-217	LCP83-137	HoCP92-618	1960	XL95-254	LCP85-313	LCP85-336	2253
XL95-218	L92-313	HoCP92-618	1047	XL95-255	HoCP89-846	US77-017	2621
XL95-219	LCP86-429	HoCP92-618	751	XL95-256	US77-017	US77-017	48
XL95-220	HoCP92-618	HoCP92-618	279	XL95-257	HoCP90-963	US77-017	455
XL95-221	HoCP85-845	HoCP92-624	3376	XL95-258	LCP86-429	L92-312	2678
XL95-222	LCP83-137	HoCP92-624	919	XL95-259	LHo92-314	CP76-331	1478
XL95-223	Ho89-889	HoCP92-624	5532	XL95-260	L93-393	CP76-331	2776
XL95-224	HoCP85-845	CP83-644	7194	XL95-261	LCP85-313	CP76-331	1467
XL95-225	LCP85-313	CP83-644	931	XL95-262	L93-366	CP76-331	222
XL95-226	LCP86-429	CP83-644	1248	XL95-263	HoCP92-654	CP76-331	3482
XL95-227	HoCP90-923	CP78-317	175	XL95-264	HoCP91-527	CP76-331	280
XL95-228	CP70-330	HoCP92-624	585	XL95-265	CP65-357	US77-017	343
XL95-229	LCP85-313	L93-380	331	XL95-266	L93-399	US77-017	993
XL95-230	LCP85-341	L93-380	1499	XL95-267	L89-113	US77-017	205
XL95-231	LCP85-313	L93-365	1683	XL95-268	HoCP89-846	L93-386	2715
XL95-232	L93-366	L93-365	289	XL95-269	L93-386	L93-386	367
XL95-233	L93-376	L93-365	67	XL95-270	LCP85-384	95P3	1903
XL95-234	CP70-321	Ho93-769	517	XL95-271	LCP85-336	95P3	2858
XL95-235	HoCP89-846	Ho93-769	583	XL95-272	LCP82-089	95P3	2790
XL95-236	HoCP90-923	Ho93-769	805	Total			310334
XL95-237	Ho93-769	Ho93-769	0				

Table 8. Cross and seed made in 1995 sorted by female parent.

Cross	Female	Male	Seed	Cross	Female	Male	Seed
XL95-084	CP65-357	HoCP90-941	161	XL95-234	CP70-321	Ho93-769	517
XL95-024	CP65-357	HoCP91-559	225	XL95-030	CP70-330	CP70-330	0
XL95-087	CP65-357	HoCP92-654	63	XL95-228	CP70-330	HoCP92-624	585
XL95-051	CP65-357	LCP82-089	1115	XL95-074	CP70-330	LCP82-089	888
XL95-075	CP65-357	LCP82-089	2303	XL95-104	CP70-330	L92-312	287
XL95-076	CP65-357	L93-391	815	XL95-214	CP70-330	L92-312	2006
XL95-265	CP65-357	US77-017	343	XL95-210	CP70-330	L93-380	1435

Table 8. continued.

Cross	Female	Male	Seed
XL95-244	CP76-331	CP76-331	942
XL95-009	CP78-317	CP78-317	0
XL95-006	CP78-317	HoCP90-941	0
XL95-001	CP78-317	HoCP92-675	36
XL95-124	CP78-317	LCP81-030	311
XL95-019	CP79-318	CP79-318	570
XL95-015	CP79-318	L92-312	1122
XL95-057	CP79-318	L92-312	171
XL95-067	CP79-318	US77-010	2294
XL95-203	CP83-644	CP83-644	988
XL95-121	CP84-772	CP84-772	154
XL95-029	CP87-625	CP70-330	0
XL95-012	CP87-625	HoCP85-845	0
XL95-005	CP87-625	HoCP90-941	0
XL95-148	CP87-625	HoCP91-552	329
XL95-004	CP87-625	HoCP92-675	95
XL95-093	CP87-625	HoCP92-675	15
XL95-199	CP87-625	L92-312	696
XL95-010	CP87-625	L92-321	19
XL95-061	CP87-625	L93-391	236
XL95-100	CP87-625	US77-010	211
XL95-036	HoCP85-845	CP70-330	162
XL95-116	HoCP85-845	CP78-317	869
XL95-018	HoCP85-845	CP79-318	4380
XL95-179	HoCP85-845	CP79-318	908
XL95-224	HoCP85-845	CP83-644	7194
XL95-118	HoCP85-845	CP84-772	348
XL95-013	HoCP85-845	HoCP85-845	16
XL95-086	HoCP85-845	HoCP90-941	66
XL95-071	HoCP85-845	HoCP90-963	212
XL95-162	HoCP85-845	HoCP91-527	1168
XL95-149	HoCP85-845	HoCP91-552	5655
XL95-221	HoCP85-845	HoCP92-624	3376
XL95-157	HoCP85-845	HoCP92-674	702
XL95-122	HoCP85-845	LCP81-030	2216
XL95-146	HoCP85-845	LCP85-371	1280
XL95-016	HoCP85-845	L92-312	1120
XL95-014	HoCP85-845	L92-321	926
XL95-145	HoCP85-845	L92-321	2016
XL95-115	HoCP85-845	L93-391	1112
XL95-099	HoCP85-845	US77-010	2208
XL95-082	HoCP85-845	US78-020	609
XL95-192	HoCP85-845	95P1	1461
XL95-247	HoCP85-845	95P2	5258
XL95-194	HoCP88-739	LCP85-384	618
XL95-117	HoCP89-846	CP78-317	371
XL95-085	HoCP89-846	HoCP90-941	13
XL95-069	HoCP89-846	HoCP90-963	12
XL95-133	HoCP89-846	HoCP91-552	2579
XL95-063	HoCP89-846	HoCP91-559	673
XL95-182	HoCP89-846	HoCP92-624	274
XL95-089	HoCP89-846	HoCP92-654	223
XL95-204	HoCP89-846	HoCP92-654	1326
XL95-207	HoCP89-846	HoCP92-674	2757
XL95-091	HoCP89-846	HoCP92-675	584
XL95-235	HoCP89-846	Ho93-769	583
XL95-096	HoCP89-846	LCP81-030	766
XL95-052	HoCP89-846	LCP82-089	2772
XL95-195	HoCP89-846	LCP85-336	1020
XL95-048	HoCP89-846	LCP85-384	43
XL95-031	HoCP89-846	LCP86-454	466
XL95-112	HoCP89-846	LHo92-314	1325
XL95-130	HoCP89-846	L92-310	0
XL95-216	HoCP89-846	L92-321	1584
XL95-185	HoCP89-846	L93-363	1220
XL95-109	HoCP89-846	L93-365	179
XL95-268	HoCP89-846	L93-386	2715
XL95-058	HoCP89-846	L93-391	1307
XL95-065	HoCP89-846	US77-010	1337
XL95-255	HoCP89-846	US77-017	2621
XL95-197	HoCP89-846	US78-020	3282
XL95-243	HoCP90-923	CP76-331	1086
XL95-227	HoCP90-923	CP78-317	175
XL95-236	HoCP90-923	Ho93-769	805
XL95-008	HoCP90-941	CP78-317	24
XL95-007	HoCP90-941	HoCP90-941	0
XL95-172	HoCP90-941	HoCP92-674	549
XL95-102	HoCP90-941	LCP82-089	1618
XL95-056	HoCP90-941	L92-312	424
XL95-213	HoCP90-941	L92-312	640
XL95-187	HoCP90-941	L93-363	758
XL95-108	HoCP90-941	L93-365	100
XL95-114	HoCP90-941	L93-391	1166
XL95-064	HoCP90-957	HoCP91-559	83
XL95-252	HoCP90-957	HoCP91-559	567
XL95-159	HoCP90-957	HoCP92-674	1531
XL95-241	HoCP90-957	LCP81-010	845
XL95-094	HoCP90-957	LCP81-030	812
XL95-101	HoCP90-957	LCP82-089	1020
XL95-111	HoCP90-957	LHo92-314	390
XL95-143	HoCP90-957	L92-310	1735
XL95-127	HoCP90-957	L92-312	0
XL95-107	HoCP90-957	L93-365	92
XL95-059	HoCP90-957	L93-391	531
XL95-066	HoCP90-957	US77-010	1338
XL95-198	HoCP90-957	US78-020	350
XL95-152	HoCP90-963	CP78-317	202
XL95-120	HoCP90-963	CP84-772	35
XL95-042	HoCP90-963	HoCP85-845	193
XL95-072	HoCP90-963	HoCP90-963	0
XL95-123	HoCP90-963	LCP81-030	86
XL95-139	HoCP90-963	LCP82-089	481

Table 8. continued.

Cross	Female	Male	Seed	Cross	Female	Male	Seed
XL95-212	HoCP90-963	LCP85-336	2763	XL95-097	LCP85-313	LCP81-030	452
XL95-206	HoCP90-963	LCP85-384	310	XL95-137	LCP85-313	LCP85-336	0
XL95-131	HoCP90-963	L92-310	167	XL95-254	LCP85-313	LCP85-336	2253
XL95-038	HoCP90-963	L92-312	89	XL95-205	LCP85-313	LCP85-384	367
XL95-186	HoCP90-963	L93-363	147	XL95-033	LCP85-313	LCP86-454	870
XL95-060	HoCP90-963	L93-391	259	XL95-126	LCP85-313	L92-312	0
XL95-077	HoCP90-963	L93-391	96	XL95-215	LCP85-313	L92-321	1200
XL95-079	HoCP90-963	US77-010	50	XL95-238	LCP85-313	L92-355	407
XL95-257	HoCP90-963	US77-017	455	XL95-141	LCP85-313	L93-365	392
XL95-081	HoCP90-963	US78-020	64	XL95-231	LCP85-313	L93-365	1683
XL95-264	HoCP91-527	CP76-331	280	XL95-229	LCP85-313	L93-380	331
XL95-163	HoCP91-527	HoCP91-527	53	XL95-078	LCP85-313	L93-391	1950
XL95-136	HoCP91-552	HoCP91-552	3973	XL95-138	LCP85-336	LCP85-336	4182
XL95-246	HoCP91-552	95P2	596	XL95-271	LCP85-336	95P3	2858
XL95-027	HoCP91-559	HoCP91-559	58	XL95-103	LCP85-341	LCP82-089	750
XL95-003	HoCP91-559	HoCP92-675	30	XL95-105	LCP85-341	L92-312	586
XL95-095	HoCP91-559	LCP81-030	878	XL95-230	LCP85-341	L93-380	1499
XL95-140	HoCP91-559	L93-365	337	XL95-190	LCP85-341	95P1	1377
XL95-220	HoCP92-618	HoCP92-618	279	XL95-125	LCP85-371	LCP81-030	0
XL95-184	HoCP92-624	HoCP92-624	279	XL95-147	LCP85-371	LCP85-371	113
XL95-053	HoCP92-624	LCP82-089	2252	XL95-106	LCP85-371	L92-312	881
XL95-073	HoCP92-624	LCP82-089	1771	XL95-050	LCP85-384	LCP85-384	29
XL95-154	HoCP92-624	LCP82-089	4021	XL95-270	LCP85-384	95P3	1903
XL95-025	HoCP92-629	HoCP91-559	59	XL95-028	LCP86-429	CP70-330	59
XL95-263	HoCP92-654	CP76-331	3482	XL95-248	LCP86-429	CP76-331	827
XL95-090	HoCP92-654	HoCP92-654	747	XL95-022	LCP86-429	CP79-318	2591
XL95-160	HoCP92-674	HoCP92-674	108	XL95-226	LCP86-429	CP83-644	1248
XL95-002	HoCP92-675	HoCP92-675	769	XL95-173	LCP86-429	HoCP91-552	271
XL95-223	Ho89-889	HoCP92-624	5532	XL95-219	LCP86-429	HoCP92-618	751
XL95-200	Ho89-889	L92-312	6547	XL95-181	LCP86-429	HoCP92-624	236
XL95-237	Ho93-769	Ho93-769	0	XL95-049	LCP86-429	LCP85-384	294
XL95-177	LCP81-010	LCP81-010	1470	XL95-193	LCP86-429	LCP85-384	0
XL95-128	LCP81-010	LCP81-030	6039	XL95-020	LCP86-429	L92-312	1987
XL95-098	LCP81-030	LCP81-030	96	XL95-039	LCP86-429	L92-312	1394
XL95-055	LCP82-089	LCP82-089	3737	XL95-258	LCP86-429	L92-312	2678
XL95-189	LCP82-089	95P1	0	XL95-239	LCP86-429	L92-355	126
XL95-272	LCP82-089	95P3	2790	XL95-034	LCP86-454	LCP86-454	205
XL95-249	LCP83-137	CP76-331	1479	XL95-259	LHo92-314	CP76-331	1478
XL95-201	LCP83-137	CP83-644	1709	XL95-113	LHo92-314	LHo92-314	49
XL95-170	LCP83-137	HoCP91-552	2366	XL95-202	L89-113	CP83-644	1766
XL95-217	LCP83-137	HoCP92-618	1960	XL95-208	L89-113	L93-380	342
XL95-183	LCP83-137	HoCP92-624	831	XL95-267	L89-113	US77-017	205
XL95-222	LCP83-137	HoCP92-624	919	XL95-035	L91-281	CP70-330	630
XL95-175	LCP83-137	L92-321	1543	XL95-174	L91-281	CP78-317	813
XL95-242	LCP85-313	CP76-331	451	XL95-044	L91-281	CP79-318	589
XL95-261	LCP85-313	CP76-331	1467	XL95-178	L91-281	CP79-318	1318
XL95-023	LCP85-313	CP79-318	1568	XL95-041	L91-281	HoCP85-845	2480
XL95-225	LCP85-313	CP83-644	931	XL95-070	L91-281	HoCP90-963	88
XL95-119	LCP85-313	CP84-772	29	XL95-151	L91-281	HoCP91-552	2913
XL95-135	LCP85-313	HoCP91-552	1752	XL95-169	L91-281	HoCP91-552	3067
XL95-092	LCP85-313	HoCP92-675	77	XL95-026	L91-281	HoCP91-559	171

Table 8. continued.

Cross	Female	Male	Seed	Cross	Female	Male	Seed
XL95-180	L91-281	HoCP92-624	726	XL95-240	L92-355	L92-355	0
XL95-158	L91-281	HoCP92-674	4265	XL95-188	L93-363	L93-363	133
XL95-176	L91-281	LCP81-010	2668	XL95-191	L93-363	95P1	1441
XL95-155	L91-281	LCP81-030	2552	XL95-110	L93-365	L93-365	45
XL95-054	L91-281	LCP82-089	2986	XL95-262	L93-366	CP76-331	222
XL95-164	L91-281	LCP82-089	6222	XL95-150	L93-366	HoCP91-552	301
XL95-165	L91-281	LCP85-336	4391	XL95-253	L93-366	HoCP91-559	128
XL95-168	L91-281	LCP85-371	1910	XL95-232	L93-366	L93-365	289
XL95-047	L91-281	LCP85-384	366	XL95-233	L93-376	L93-365	67
XL95-032	L91-281	LCP86-454	1080	XL95-196	L93-380	LCP85-336	947
XL95-166	L91-281	LHo92-314	579	XL95-209	L93-380	L93-380	331
XL95-021	L91-281	L92-312	984	XL95-269	L93-386	L93-386	367
XL95-037	L91-281	L92-312	2265	XL95-062	L93-391	L93-391	220
XL95-161	L91-281	L92-312	1313	XL95-260	L93-393	CP76-331	2776
XL95-043	L91-281	L92-321	2865	XL95-153	L93-399	CP78-317	460
XL95-144	L91-281	L92-321	6347	XL95-040	L93-399	HoCP85-845	1338
XL95-167	L91-281	L93-365	1958	XL95-171	L93-399	HoCP91-552	1308
XL95-080	L91-281	US77-010	2238	XL95-156	L93-399	LCP81-030	2175
XL95-045	L91-281	US78-020	3790	XL95-251	L93-399	LCP82-089	2982
XL95-132	L92-310	L92-310	298	XL95-211	L93-399	LCP85-336	2462
XL95-017	L92-312	L92-312	359	XL95-250	L93-399	L92-312	2933
XL95-245	L92-312	95P2	2663	XL95-266	L93-399	US77-017	993
XL95-134	L92-313	HoCP91-552	1174	XL95-083	L93-399	US78-020	595
XL95-218	L92-313	HoCP92-618	1047	XL95-068	US77-010	US77-010	793
XL95-088	L92-313	HoCP92-654	154	XL95-256	US77-017	US77-017	48
XL95-129	L92-313	LCP81-030	855	XL95-046	US78-020	US78-020	24
XL95-142	L92-313	L93-365	0	Total			310334
XL95-011	L92-321	L92-321	97				

Table 9. Cross and seed made in 1995 sorted by male parent.

Cross	Female	Male	Seed	Cross	Female	Male	Seed
XL95-030	CP70-330	CP70-330	0	XL95-116	HoCP85-845	CP78-317	869
XL95-029	CP87-625	CP70-330	0	XL95-117	HoCP89-846	CP78-317	371
XL95-036	HoCP85-845	CP70-330	162	XL95-227	HoCP90-923	CP78-317	175
XL95-028	LCP86-429	CP70-330	59	XL95-008	HoCP90-941	CP78-317	24
XL95-035	L91-281	CP70-330	630	XL95-152	HoCP90-963	CP78-317	202
XL95-244	CP76-331	CP76-331	942	XL95-174	L91-281	CP78-317	813
XL95-243	HoCP90-923	CP76-331	1086	XL95-153	L93-399	CP78-317	460
XL95-264	HoCP91-527	CP76-331	280	XL95-019	CP79-318	CP79-318	570
XL95-263	HoCP92-654	CP76-331	3482	XL95-018	HoCP85-845	CP79-318	4380
XL95-249	LCP83-137	CP76-331	1479	XL95-179	HoCP85-845	CP79-318	908
XL95-242	LCP85-313	CP76-331	451	XL95-023	LCP85-313	CP79-318	1568
XL95-261	LCP85-313	CP76-331	1467	XL95-022	LCP86-429	CP79-318	2591
XL95-248	LCP86-429	CP76-331	827	XL95-044	L91-281	CP79-318	589
XL95-259	LHo92-314	CP76-331	1478	XL95-178	L91-281	CP79-318	1318
XL95-262	L93-366	CP76-331	222	XL95-203	CP83-644	CP83-644	988
XL95-260	L93-393	CP76-331	2776	XL95-224	HoCP85-845	CP83-644	7194
XL95-009	CP78-317	CP78-317	0	XL95-201	LCP83-137	CP83-644	1709

Table 9. continued.

Cross	Female	Male	Seed
XL95-225	LCP85-313	CP83-644	931
XL95-226	LCP86-429	CP83-644	1248
XL95-202	L89-113	CP83-644	1766
XL95-121	CP84-772	CP84-772	154
XL95-118	HoCP85-845	CP84-772	348
XL95-120	HoCP90-963	CP84-772	35
XL95-119	LCP85-313	CP84-772	29
XL95-012	CP87-625	HoCP85-845	0
XL95-013	HoCP85-845	HoCP85-845	16
XL95-042	HoCP90-963	HoCP85-845	193
XL95-041	L91-281	HoCP85-845	2480
XL95-040	L93-399	HoCP85-845	1338
XL95-084	CP65-357	HoCP90-941	161
XL95-006	CP78-317	HoCP90-941	0
XL95-005	CP87-625	HoCP90-941	0
XL95-086	HoCP85-845	HoCP90-941	66
XL95-085	HoCP89-846	HoCP90-941	13
XL95-007	HoCP90-941	HoCP90-941	0
XL95-071	HoCP85-845	HoCP90-963	212
XL95-069	HoCP89-846	HoCP90-963	12
XL95-072	HoCP90-963	HoCP90-963	0
XL95-070	L91-281	HoCP90-963	88
XL95-162	HoCP85-845	HoCP91-527	1168
XL95-163	HoCP91-527	HoCP91-527	53
XL95-148	CP87-625	HoCP91-552	329
XL95-149	HoCP85-845	HoCP91-552	5655
XL95-133	HoCP89-846	HoCP91-552	2579
XL95-136	HoCP91-552	HoCP91-552	3973
XL95-170	LCP83-137	HoCP91-552	2366
XL95-135	LCP85-313	HoCP91-552	1752
XL95-173	LCP86-429	HoCP91-552	271
XL95-151	L91-281	HoCP91-552	2913
XL95-169	L91-281	HoCP91-552	3067
XL95-134	L92-313	HoCP91-552	1174
XL95-150	L93-366	HoCP91-552	301
XL95-171	L93-399	HoCP91-552	1308
XL95-024	CP65-357	HoCP91-559	225
XL95-063	HoCP89-846	HoCP91-559	673
XL95-064	HoCP90-957	HoCP91-559	83
XL95-252	HoCP90-957	HoCP91-559	567
XL95-027	HoCP91-559	HoCP91-559	58
XL95-025	HoCP92-629	HoCP91-559	59
XL95-026	L91-281	HoCP91-559	171
XL95-253	L93-366	HoCP91-559	128
XL95-220	HoCP92-618	HoCP92-618	279
XL95-217	LCP83-137	HoCP92-618	1960
XL95-219	LCP86-429	HoCP92-618	751
XL95-218	L92-313	HoCP92-618	1047
XL95-228	CP70-330	HoCP92-624	585
XL95-221	HoCP85-845	HoCP92-624	3376
XL95-182	HoCP89-846	HoCP92-624	274
XL95-184	HoCP92-624	HoCP92-624	279
XL95-223	Ho89-889	HoCP92-624	5532
XL95-183	LCP83-137	HoCP92-624	831
XL95-222	LCP83-137	HoCP92-624	919
XL95-181	LCP86-429	HoCP92-624	236
XL95-180	L91-281	HoCP92-624	726
XL95-087	CP65-357	HoCP92-654	63
XL95-089	HoCP89-846	HoCP92-654	223
XL95-204	HoCP89-846	HoCP92-654	1326
XL95-090	HoCP92-654	HoCP92-654	747
XL95-088	L92-313	HoCP92-654	154
XL95-157	HoCP85-845	HoCP92-674	702
XL95-207	HoCP89-846	HoCP92-674	2757
XL95-172	HoCP90-941	HoCP92-674	549
XL95-159	HoCP90-957	HoCP92-674	1531
XL95-160	HoCP92-674	HoCP92-674	108
XL95-158	L91-281	HoCP92-674	4265
XL95-001	CP78-317	HoCP92-675	36
XL95-004	CP87-625	HoCP92-675	95
XL95-093	CP87-625	HoCP92-675	15
XL95-091	HoCP89-846	HoCP92-675	584
XL95-003	HoCP91-559	HoCP92-675	30
XL95-002	HoCP92-675	HoCP92-675	769
XL95-092	LCP85-313	HoCP92-675	77
XL95-234	CP70-321	Ho93-769	517
XL95-235	HoCP89-846	Ho93-769	583
XL95-236	HoCP90-923	Ho93-769	805
XL95-237	Ho93-769	Ho93-769	0
XL95-241	HoCP90-957	LCP81-010	845
XL95-177	LCP81-010	LCP81-010	1470
XL95-176	L91-281	LCP81-010	2668
XL95-124	CP78-317	LCP81-030	311
XL95-122	HoCP85-845	LCP81-030	2216
XL95-096	HoCP89-846	LCP81-030	766
XL95-094	HoCP90-957	LCP81-030	812
XL95-123	HoCP90-963	LCP81-030	86
XL95-095	HoCP91-559	LCP81-030	878
XL95-128	LCP81-010	LCP81-030	6039
XL95-098	LCP81-030	LCP81-030	96
XL95-097	LCP85-313	LCP81-030	452
XL95-125	LCP85-371	LCP81-030	0
XL95-155	L91-281	LCP81-030	2552
XL95-129	L92-313	LCP81-030	855
XL95-156	L93-399	LCP81-030	2175
XL95-051	CP65-357	LCP82-089	1115
XL95-075	CP65-357	LCP82-089	2303
XL95-074	CP70-330	LCP82-089	888
XL95-052	HoCP89-846	LCP82-089	2772
XL95-102	HoCP90-941	LCP82-089	1618
XL95-101	HoCP90-957	LCP82-089	1020
XL95-139	HoCP90-963	LCP82-089	481

Table 9. continued.

Cross	Female	Male	Seed	Cross	Female	Male	Seed
XL95-053	HoCP92-624	LCP82-089	2252	XL95-105	LCP85-341	L92-312	586
XL95-073	HoCP92-624	LCP82-089	1771	XL95-106	LCP85-371	L92-312	881
XL95-154	HoCP92-624	LCP82-089	4021	XL95-020	LCP86-429	L92-312	1987
XL95-055	LCP82-089	LCP82-089	3737	XL95-039	LCP86-429	L92-312	1394
XL95-103	LCP85-341	LCP82-089	750	XL95-258	LCP86-429	L92-312	2678
XL95-054	L91-281	LCP82-089	2986	XL95-021	L91-281	L92-312	984
XL95-164	L91-281	LCP82-089	6222	XL95-037	L91-281	L92-312	2265
XL95-251	L93-399	LCP82-089	2982	XL95-161	L91-281	L92-312	1313
XL95-195	HoCP89-846	LCP85-336	1020	XL95-017	L92-312	L92-312	359
XL95-212	HoCP90-963	LCP85-336	2763	XL95-250	L93-399	L92-312	2933
XL95-137	LCP85-313	LCP85-336	0	XL95-010	CP87-625	L92-321	19
XL95-254	LCP85-313	LCP85-336	2253	XL95-014	HoCP85-845	L92-321	926
XL95-138	LCP85-336	LCP85-336	4182	XL95-145	HoCP85-845	L92-321	2016
XL95-165	L91-281	LCP85-336	4391	XL95-216	HoCP89-846	L92-321	1584
XL95-196	L93-380	LCP85-336	947	XL95-175	LCP83-137	L92-321	1543
XL95-211	L93-399	LCP85-336	2462	XL95-215	LCP85-313	L92-321	1200
XL95-146	HoCP85-845	LCP85-371	1280	XL95-043	L91-281	L92-321	2865
XL95-147	LCP85-371	LCP85-371	113	XL95-144	L91-281	L92-321	6347
XL95-168	L91-281	LCP85-371	1910	XL95-011	L92-321	L92-321	97
XL95-194	HoCP88-739	LCP85-384	618	XL95-238	LCP85-313	L92-355	407
XL95-048	HoCP89-846	LCP85-384	43	XL95-239	LCP86-429	L92-355	126
XL95-206	HoCP90-963	LCP85-384	310	XL95-240	L92-355	L92-355	0
XL95-205	LCP85-313	LCP85-384	367	XL95-185	HoCP89-846	L93-363	1220
XL95-050	LCP85-384	LCP85-384	29	XL95-187	HoCP90-941	L93-363	758
XL95-049	LCP86-429	LCP85-384	294	XL95-186	HoCP90-963	L93-363	147
XL95-193	LCP86-429	LCP85-384	0	XL95-188	L93-363	L93-363	133
XL95-047	L91-281	LCP85-384	366	XL95-109	HoCP89-846	L93-365	179
XL95-031	HoCP89-846	LCP86-454	466	XL95-108	HoCP90-941	L93-365	100
XL95-033	LCP85-313	LCP86-454	870	XL95-107	HoCP90-957	L93-365	92
XL95-034	LCP86-454	LCP86-454	205	XL95-140	HoCP91-559	L93-365	337
XL95-032	L91-281	LCP86-454	1080	XL95-141	LCP85-313	L93-365	392
XL95-112	HoCP89-846	LHo92-314	1325	XL95-231	LCP85-313	L93-365	1683
XL95-111	HoCP90-957	LHo92-314	390	XL95-167	L91-281	L93-365	1958
XL95-113	LHo92-314	LHo92-314	49	XL95-142	L92-313	L93-365	0
XL95-166	L91-281	LHo92-314	579	XL95-110	L93-365	L93-365	45
XL95-130	HoCP89-846	L92-310	0	XL95-232	L93-366	L93-365	289
XL95-143	HoCP90-957	L92-310	1735	XL95-233	L93-376	L93-365	67
XL95-131	HoCP90-963	L92-310	167	XL95-210	CP70-330	L93-380	1435
XL95-132	L92-310	L92-310	298	XL95-229	LCP85-313	L93-380	331
XL95-104	CP70-330	L92-312	287	XL95-230	LCP85-341	L93-380	1499
XL95-214	CP70-330	L92-312	2006	XL95-208	L89-113	L93-380	342
XL95-015	CP79-318	L92-312	1122	XL95-209	L93-380	L93-380	331
XL95-057	CP79-318	L92-312	171	XL95-268	HoCP89-846	L93-386	2715
XL95-199	CP87-625	L92-312	696	XL95-269	L93-386	L93-386	367
XL95-016	HoCP85-845	L92-312	1120	XL95-076	CP65-357	L93-391	815
XL95-056	HoCP90-941	L92-312	424	XL95-061	CP87-625	L93-391	236
XL95-213	HoCP90-941	L92-312	640	XL95-115	HoCP85-845	L93-391	1112
XL95-127	HoCP90-957	L92-312	0	XL95-058	HoCP89-846	L93-391	1307
XL95-038	HoCP90-963	L92-312	89	XL95-114	HoCP90-941	L93-391	1166
XL95-200	Ho89-889	L92-312	6547	XL95-059	HoCP90-957	L93-391	531
XL95-126	LCP85-313	L92-312	0	XL95-060	HoCP90-963	L93-391	259

Table 9. continued.

Cross	Female	Male	Seed
XL95-077	HoCP90-963	L93-391	96
XL95-078	LCP85-313	L93-391	1950
XL95-062	L93-391	L93-391	220
XL95-067	CP79-318	US77-010	2294
XL95-100	CP87-625	US77-010	211
XL95-099	HoCP85-845	US77-010	2208
XL95-065	HoCP89-846	US77-010	1337
XL95-066	HoCP90-957	US77-010	1338
XL95-079	HoCP90-963	US77-010	50
XL95-080	L91-281	US77-010	2238
XL95-068	US77-010	US77-010	793
XL95-265	CP65-357	US77-017	343
XL95-255	HoCP89-846	US77-017	2621
XL95-257	HoCP90-963	US77-017	455
XL95-267	L89-113	US77-017	205
XL95-266	L93-399	US77-017	993
XL95-256	US77-017	US77-017	48
XL95-082	HoCP85-845	US78-020	609
XL95-197	HoCP89-846	US78-020	3282
XL95-198	HoCP90-957	US78-020	350
XL95-081	HoCP90-963	US78-020	64
XL95-045	L91-281	US78-020	3790
XL95-083	L93-399	US78-020	595
XL95-046	US78-020	US78-020	24
XL95-192	HoCP85-845	95P1	1461
XL95-189	LCP82-089	95P1	0
XL95-190	LCP85-341	95P1	1377
XL95-191	L93-363	95P1	1441
XL95-247	HoCP85-845	95P2	5258
XL95-246	HoCP91-552	95P2	596
XL95-245	L92-312	95P2	2663
XL95-272	LCP82-089	95P3	2790
XL95-271	LCP85-336	95P3	2858
XL95-270	LCP85-384	95P3	1903
Total			310334

SELECTIONS, ADVANCEMENTS, AND ASSIGNMENTS OF THE LOUISIANA "L" SUGARCANE VARIETY DEVELOPMENT PROGRAM FOR THE YEAR 1995

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SUMMARY

Selection of superior genotypes from superior crosses is the primary objective of this phase of the program. A total of 74,450 seedlings from 201 crosses was planted to the field in the spring of 1995. Most of the seedlings were from crosses among commercial varieties and elite experimental varieties. In the fall of 1995, individual selection was practiced on 25,492 stubble seedlings that represented the top 54% of the families in the program. Superior phenotypes were selected and advanced (3219 to first line, 650 to second line, and 391 to increase). The best 47 clones from the 1990 crossing series were assigned permanent variety numbers in the fall of 1995.

PROCEDURES

In the selection stage of the Louisiana Sugarcane Variety Development Program, single stools are established from seed generated in the crossing stage. After evaluating and selecting the families for cane yield potential, clones of desirable phenotypes are selected and advanced through single stool seedling, first line, second line, and increase stages. At the end of this stage, each clone that is judged to have breeding or commercial value is assigned a permanent variety number and advanced to the nursery stage of testing.

RESULTS AND DISCUSSION

A total of 74,450 seedlings from 201 crosses of the 1994 crossing series was planted to the field in the spring of 1995 (Table 1). The majority of the seedling progeny originated from crosses among commercial and elite experimental varieties. In the first stage of advancement, stalks from selected stubble-single stool seedlings are cut and planted to six-foot first line trial plots. In the fall of 1995, individual selection was practiced on 25,492 stubble seedlings that represented the top 54% of the 160 families available from the 1993 crossing series. Superior families were identified using the cross appraisal system. Of the 25,492 clones in the selected families, 3,219 were planted in the first line trials.

Nearly 3,000 first line trial plots of the 1992 crossing series were rated for cane yield and pest resistance in August of 1995 (Table 2a). After screening for cane yield rating, acceptable clones were further evaluated for pest resistance, stalk quality, and Brix (Table 2b). The second stage of advancement was concluded with the planting of 650 clones in sixteen-foot second line trial plots.

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Advancement from second line trials to the increase stage was initiated with stalk counts of the 670 clonal plots of the 1991 crossing series in August 1995. Based on these counts and the previously mentioned criteria, 391 clones were planted in two sixteen-foot increase plots (Table 3). These clones will be candidates for assignment in 1996. Of the 288 available, the best 47 clones from the 1990 crossing series (Table 4) were assigned permanent variety numbers in the fall of 1995. Newly assigned varieties were entered in replicated nursery trials at three locations. The exchange of "L" and "HoCP" varieties, which was curtailed when leaf scald was discovered at Chacahoula in 1992, was resumed in 1995 after leaf scald was observed at the St. Gabriel Station in 1994.

The advancement summary of clones from crosses made in 1990 through 1993 is shown in Table 5. Crosses are sorted by female parent in ascending order with the percentile ranking given for each cross in each stage of the program. Results of the cross appraisal conducted on the 1993 series are given in Table 6. Based on these results, only those families exhibiting superior characteristics were selected from the general seedling population. Those families with poor performance were avoided.

Table 1. Summary of selections, advancements, and assignments made during 1995 by the Louisiana, "L", Sugarcane Variety Development Program's personnel.

Crossing series	Crosses		Plants surviving transplanting†	Overwintered plants	Advanced to			
	Progeny test	Selection program			1st line	2nd line	Increase	Nursery (Assigned)
			number of clones					
X90	258	199	55609	48687	3555	450	288	47§
X91	213	165	55625		2690	670	391§	
X92	134	106	49655		2990	650§		
X93	213	160‡	50554		3365			
X94	154	201	74450§		§			

† Plant number is for plants in the regular selection program only. An additional 60 plants are planted from each cross in the progeny test.

‡ Of the 160 crosses planted into the regular seedling stage selection program, 87 (54%) crosses were selected. From the 25,492 overwintering progeny from the selected crosses (58% of all overwintering progeny), 3219 were advanced to the 1st line stage. The remaining 1st line clones were part of a selection study.

§ Experimental clones selected and planted into this stage in 1995.

Table 2a. Ratings and initial faults of clones in the first line plant cane of the 1992 crossing series.

Variety - fault	Initial no.	Cane yield rating							Clones < 7
		3	4	5	6	7	8	9	
	number of clones								
Exptl. - no fault	2908	4	49	596	989	1107	150	13	1638
Exptl. - borer			0	1	0	5	0	0	1
Exptl. - lodged			0	0	1	24	2	0	0
Exptl. - rust			0	0	0	7	0	0	0
Exptl. - smut			0	5	4	15	3	1	9
Exptl. - sum			49	602	994	1158	155	14	1648
CP70-321 - none	57	0	4	25	16	12	0	0	45
CP72-370 - none			1	30	21	1	1	0	52
CP72-370 - borer			0	2	0	0	0	0	2
CP72-370 - smut			0	1	0	0	0	0	1
Check - sum			5	58	37	13	1	0	100

Table 2b. Numbers of experimental clones dropped for identified faults in the 1992 crossing series first line trial after the initial selection stage.

Round of Evaluation	Fault	Number
First		
	Borer	102
	Brittle or Broken	20
	Excessive lateral buds	34
	Smut	161
	Leaf Scald	1
	Pokabone	2
	Lodged	189
	Low stalk number	4
	Short*	12
	Stalk size	12
	Tube	4
	No reason given	7
Second		
	Pith	286
Third		
	Brix	266
Advanced	None reported	650

*Mostly for small diameter

Table 3. Numbers of experimental clones dropped for identified faults in the 1991 crossing series second line trial prior to advancement to increase stage.

Round of Evaluation	Fault	Number
First		
	Low stalk number*	146
Second		
	Borer	11
	Brittle	1
	Broken	1
	Lodged	29
	Short	7
	Smut	41
Third		
	Pith	49
	Tube	3
Advanced	None reported	391

*Only clones with stalk numbers higher than those of the checks (CP70-321 and LCP82-089) were evaluated in the second and third round of evaluation.

Table 4. Yield data summary of 1995 "L" assignments.

Variety	Cross	Female	Male	Sucrose yield	Cane yield	Sucrose conc.	Stalk number	Stalk weight
				lbs/A	t/A	lbs/t	no./A	lbs.
CP70-321				10271	41.3	262	31636	2.57
CP72-370				9458	35.1	270	27830	2.55
L95-448	XL88-196	CP83-644	CP57-614	13959	51.4	271	28473	3.44
L95-449	XL88-196	CP83-644	CP57-614	10225	37.8	276	30628	2.53
L95-450	XL88-379	CP78-357	LCP81-010	9981	41.4	247	34485	2.41
L95-451	XL90-164	LCP86-429	LCP86-395	8378	35.7	248	37548	1.99
L95-452	XL90-135	LCP86-429	LCP85-384	10144	39.5	261	39930	2.04
L95-453	XL90-135	LCP86-429	LCP85-384	9910	38.3	257	31876	2.35
L95-455	XL90-135	LCP86-429	LCP85-384	10147	38.3	268	35506	2.17
L95-456	XL90-162	LCP86-429	LCP86-402	10792	41.0	267	29266	2.72
L95-457	XL90-218	LCP86-408	CP70-321	8532	31.8	265	29380	2.13
L95-458	XL90-089	CP78-317	LCP86-402	6636	27.6	252	28473	1.96
L95-459	XL90-318	CP70-330	CP83-644	11117	46.1	240	41745	2.31
L95-460	XL90-341	LCP85-336	90P3	10216	41.9	255	39022	2.21
L95-461	XL90-302	LCP81-015	LCP86-402	13997	55.5	254	39590	2.87
L95-462	XL90-243	LCP85-384	LCP85-336	13744	52.5	266	36867	2.70
L95-463	XL90-112	US77-010	US77-010	9962	39.4	252	42539	1.78
L95-464	XL90-225	CP72-370	LCP85-384	8522	35.7	244	35846	1.92
L95-465	XL90-239	LCP86-393	CP77-310	8874	35.1	259	37434	1.90
L95-466	XL90-188	CP75-361	LCP85-384	11258	40.8	280	43219	1.95
L95-467	XL90-161	LCP86-429	L88-063	12552	52.3	252	45375	2.32
L95-468	XL90-161	LCP86-429	L88-063	9955	39.7	257	35052	2.33
L95-469	XL90-161	LCP86-429	L88-063	12758	46.4	276	31308	2.90
L95-470	XL90-192	LCP81-030	CP72-370	9458	34.3	279	32897	2.15
L95-471	XL90-186	LCP86-420	L78-063	8624	34.2	256	29947	2.29
L95-472	XL90-186	LCP86-420	L78-063	12447	48.6	256	46396	2.11
L95-473	XL90-081	CP76-351	CP87-618	8775	33.0	272	23482	2.32
L95-474	XL90-188	CP75-361	LCP85-384	8564	34.1	258	37434	1.91
L95-475	XL90-188	CP75-361	LCP85-384	10798	43.6	254	34598	2.51
L95-476	XL90-188	CP75-361	LCP85-384	10733	40.3	264	34938	2.26
L95-477	XL90-243	LCP85-384	LCP85-336	13266	54.5	246	34712	3.11
L95-478	XL90-309	CP78-357	CP80-323	9395	35.6	266	39476	1.85
L95-479	XL90-248	CP76-331	LCP85-384	8247	35.4	246	36640	2.01
L95-480	XL90-244	LCP81-030	LCP85-376	9341	36.5	264	28246	2.56
L95-481	XL90-135	LCP86-429	LCP85-384	8565	33.1	268	36754	1.82
L95-482	XL90-224	CP76-351	LCP85-384	13242	52.8	253	47643	2.12
L95-483	XL90-244	LCP81-030	LCP85-376	10721	37.0	290	31649	2.40
L95-484	XL90-135	LCP86-429	LCP85-384	11051	47.2	241	41404	2.31
L95-485	XL90-243	LCP85-384	LCP85-336	12496	51.2	261	45602	2.28
L95-486	XL90-318	CP70-330	CP83-644	11869	44.8	264	34825	2.68
L95-487	Unknown	Unknown	Unknown	8877	35.0	264	29153	2.51
L95-488	XL90-135	LCP86-429	LCP85-384	7829	30.9	262	32216	1.94
L95-489	XL90-135	LCP86-429	LCP85-384	8879	34.7	261	34145	2.05
L95-490	XL90-268	CP83-644	CP77-310	9785	37.1	263	31536	2.34
L95-491	XL88-113	LCP85-384	CP80-313	9537	40.2	245	37661	2.08
L95-492	XL90-225	CP72-370	LCP85-384	8086	31.0	267	37094	1.71
L95-493	XL90-257	LCP81-030	LCP82-089	10398	41.0	255	41858	2.06
L95-494	XL90-095	L88-072	90P1	7885	27.8	289	32443	1.74
L95-495	XL90-188	CP75-361	LCP85-384	11847	44.2	273	38909	2.13
$MSD_{0.05}$				3070	9.95	23.6	6540	0.31

Table 5. Advancement summary of crosses in the 1990 through 1993 crossing series.†

				1st Line		2nd Line		Increase		Assignment	
Female	Male	Cross Series	Survive ‡	no.	Rank pcnt'l	no.	Rank pcnt'l	no.	Rank pcnt'l	no.	Rank pcnt'l
CP48-103	CP80-323	92	236	0	23	0	25	.	.	.	.
CP48-103	L83-194	90	202	11	47	2	61	1	71	0	43
CP61-037	CP67-412	90	196	1	12	0	17	0	26	0	43
CP62-258	LCP85-336	93	190	6	45	.	.	.	.	.	.
CP65-357	CP76-331	90	683	27	0	6	57	2	57	0	43
CP65-357	CP77-407	90	475	46	76	13	87	2	64	0	43
CP65-357	CP82-550	90	149	10	57	3	78	2	87	0	43
CP65-357	CP83-644	91	221	29	93	8	89	4	86	.	.
CP65-357	CP85-830	90	219	17	65	6	87	2	80	0	43
CP65-357	CP86-933	90	162	12	62	0	17	0	26	0	43
CP65-357	CP86-933	92	111	0	23	0	25	.	.	.	.
CP65-357	CP87-626	90	130	23	97	1	53	0	26	0	43
CP65-357	CP87-662	90	237	16	58	0	17	0	26	0	43
CP65-357	HoCP85-845	91	243	26	89	10	92	8	97	.	.
CP65-357	LCP81-030	90	584	44	47	10	50	4	54	0	43
CP65-357	LCP81-030	91	154	23	97	8	95	4	95	.	.
CP65-357	LCP85-384	90	194	16	68	4	80	3	91	0	43
CP65-357	LCP86-402	90	242	18	62	9	93	4	93	0	43
CP65-357	LCP86-454	90	185	30	96	9	97	3	92	0	43
CP65-357	LCP86-454	91	237	0	22	0	24	0	27	.	.
CP65-357	LCP87-496	90	216	14	55	0	17	0	26	0	43
CP65-357	LCP88-079	91	93	11	92	4	94	2	90	.	.
CP65-357	L88-063	90	256	19	62	7	87	4	92	0	43
CP65-357	L88-063	92	237	11	56	1	53	.	.	.	.
CP65-357	L88-063	93	210	29	81	.	.	.	.	.	.
CP70-1527	CP73-340	91	431	38	78	11	79	0	27	.	.
CP70-321	LCP82-089	90	242	16	56	1	42	1	64	0	43
CP70-321	LCP82-089	93	181	44	96	.	.	.	.	.	.
CP70-321	LCP85-336	91	234	0	22	0	24	0	27	.	.
CP70-321	LCP85-384	93	242	52	93	.	.	.	.	.	.
CP70-330	CP72-370	92	.	122	.	23	.	.	.	.	.
CP70-330	CP76-331	90	248	23	74	6	85	2	77	0	43
CP70-330	CP83-644	90	225	36	95	16	99	7	98	2	98
CP70-330	CP87-626	91	182	0	22	0	24	0	27	.	.
CP70-330	LCP85-384	92	704	104	84	25	83	.	.	.	.
CP70-330	LCP86-402	90	642	19	29	3	45	1	52	0	43
CP70-330	LCP86-454	90	156	1	16	0	17	0	26	0	43
CP70-330	LCP87-017	92	485	42	69	1	52	.	.	.	.
CP70-330	LCP87-023	90	206	18	70	1	47	0	26	0	43
CP70-330	LCP88-079	91	226	0	22	0	24	0	27	.	.
CP70-330	LCP88-091	91	193	0	22	0	24	0	27	.	.
CP72-1312	CP74-383	93	163	0	20	.	.	.	.	.	.
CP72-1312	89P2	93	192	15	60	.	.	.	.	.	.
CP72-2086	91P4	91	242	13	62	1	49	0	27	.	.
CP72-355	CP77-310	90	424	2	12	2	45	1	55	0	43
CP72-355	CP77-310	93	174	11	58	.	.	.	.	.	.
CP72-355	CP77-407	91	246	0	22	0	24	0	27	.	.
CP72-370	CP79-318	90	251	13	44	1	39	1	59	0	43
CP72-370	CP86-916	92	.	19	.	2	.	.	.	.	.
CP72-370	LCP81-030	91	725	75	88	23	85	6	73	.	.
CP72-370	LCP82-047	90	232	8	32	3	66	0	26	0	43
CP72-370	LCP85-384	90	405	26	54	10	86	6	91	2	95
CP72-370	LCP86-393	90	225	15	57	4	74	1	66	0	43
CP72-370	LCP87-494	90	243	1	6	0	17	0	26	0	43
CP72-370	L89-098	91	241	12	60	5	74	3	82	.	.

Table 5. Continue

Female	Male	Cross Series	Survive ‡	1st Line no.	1st Line Rank pcnt'l	2nd Line no.	2nd Line Rank pcnt'l	Increase no.	Increase Rank pcnt'l	Assignment no.	Assignment Rank Pent'l
CP72-370	92P9	92	251	37	87	12	91	.	.	.	.
CP73-340	CP77-310	92	254	0	23	0	25	.	.	.	.
CP73-340	CP80-323	91	183	24	93	12	98	5	97	.	.
CP73-345	CP62-258	90	211	1	12	0	17	0	26	0	43
CP73-345	CP62-258	92	482	0	23	0	25	.	.	.	.
CP73-345	CP77-407	90	218	11	42	2	57	1	67	0	43
CP73-345	CP78-304	90	489	2	6	0	17	0	26	0	43
CP73-345	LCP86-454	91	718	0	22	0	24	0	27	.	.
CP74-383	CP70-321	91	251	46	98	6	78	2	71	.	.
CP74-383	CP70-330	91	232	11	59	3	62	0	27	.	.
CP74-383	CP72-370	90	352	49	92	1	37	0	26	0	43
CP74-383	CP73-343	90	159	1	16	0	17	0	26	0	43
CP74-383	CP75-308	90	240	1	6	0	17	0	26	0	43
CP74-383	CP77-310	90	170	17	78	0	17	0	26	0	43
CP74-383	CP79-318	90	415	49	85	3	52	0	26	0	43
CP74-383	CP80-323	90	247	19	64	10	94	1	60	0	43
CP74-383	CP83-644	90	150	13	70	0	17	0	26	0	43
CP74-383	CP88-769	91	249	0	22	0	24	0	27	.	.
CP74-383	CP89-805	92	106	0	23	0	25	.	.	.	.
CP74-383	HoCP85-845	90	246	19	64	5	79	3	85	0	43
CP74-383	HoCP85-845	91	221	13	65	5	76	2	78	.	.
CP74-383	LCP81-030	91	249	11	57	4	66	2	71	.	.
CP74-383	LCP82-089	90	240	29	87	0	17	0	26	0	43
CP74-383	LCP85-336	90	244	9	34	0	17	0	26	0	43
CP74-383	LCP85-376	90	196	1	12	0	17	0	26	0	43
CP74-383	LCP85-384	90	430	20	41	1	36	0	26	0	43
CP74-383	LCP85-384	92	231	25	79	10	89	.	.	.	.
CP74-383	LCP88-091	91	450	41	79	10	75	6	84	.	.
CP74-383	LCP89-109	91	416	0	22	0	24	0	27	.	.
CP74-383	L88-028	91	462	0	22	0	24	0	27	.	.
CP74-383	US80-004	90	152	6	35	1	51	0	26	0	43
CP74-383	92P1	92	469	9	37	2	42	.	.	.	.
CP75-1082	90P3	90	243	5	23	1	42	1	63	0	43
CP75-1082	92P5	92	927	0	23	0	25	.	.	.	.
CP75-1082	93P5	93	234	0	20	.	.	.	.	.	.
CP75-361	CP73-343	93	107	0	20	.	.	.	.	.	.
CP75-361	CP75-1082	90	373	33	71	1	36	0	26	0	43
CP75-361	CP76-331	91	321	8	54	2	52	0	27	.	.
CP75-361	CP80-323	90	168	10	52	3	74	1	73	0	43
CP75-361	CP82-550	90	157	25	95	5	91	2	86	0	43
CP75-361	CP83-644	93	202	0	20	.	.	.	.	.	.
CP75-361	CP87-618	90	228	18	66	2	57	0	26	0	43
CP75-361	HoCP85-845	91	458	0	22	0	24	0	27	.	.
CP75-361	LCP82-089	90	35	1	28	0	17	0	26	0	43
CP75-361	LCP82-089	91	470	24	61	9	71	2	63	.	.
CP75-361	LCP85-384	90	740	114	94	43	97	28	99	5	96
CP75-361	LCP86-402	90	214	30	92	4	75	0	26	0	43
CP75-361	LCP86-454	91	100	0	22	0	24	0	27	.	.
CP75-361	LCP88-079	91	244	0	22	0	24	0	27	.	.
CP75-361	LCP88-091	91	245	26	89	10	92	3	81	.	.
CP75-361	L84-290	91	222	0	22	0	24	0	27	.	.
CP75-361	L84-290	92	235	0	23	0	25	.	.	.	.
CP75-361	L88-063	91	479	29	66	6	59	2	61	.	.
CP75-361	L89-120	91	37	0	22	0	24	0	27	.	.
CP75-361	US77-010	90	232	20	69	4	72	2	79	0	43
CP75-361	90P3	90	216	17	66	5	82	1	68	0	43

Table 5. Continue

Female	Male	Cross Series	Survive ‡	1st Line no.	1st Line Rank pcnt'l	2nd Line no.	2nd Line Rank pcnt'l	Increase no.	Increase Rank pcnt'l	Assignment no.	Assignment Rank Pent'l
CP76-331	CP77-310	90	233	1	6	0	17	0	26	0	43
CP76-331	CP78-317	91	72	5	71	1	64	1	84	.	.
CP76-331	LCP81-010	91	474	0	22	0	24	0	27	.	.
CP76-331	LCP85-384	90	593	26	40	3	47	2	58	1	87
CP76-331	LCP85-384	92	1674	272	92	58	81	.	.	.	43
CP76-331	HoCP85-845	90	238	7	28	0	17	0	26	0	43
CP76-331	LCP87-017	91	216	0	22	0	24	0	27	.	.
CP76-331	L75-056	93	210	0	20	.	.	.	.	.	.
CP76-331	L89-101	91	209	0	22	0	24	0	27	.	.
CP76-331	90P3	90	193	16	69	1	48	1	71	0	43
CP76-331	91P4	91	209	0	22	0	24	0	27	.	.
CP76-331	93P4	93	250	0	20	.	.	.	.	.	.
CP76-331	93P5	93	492	17	47	.	.	.	.	.	.
CP76-351	CP70-321	91	240	16	69	3	59	1	60	.	.
CP76-351	CP73-343	92	651	0	23	0	25	.	.	.	.
CP76-351	CP77-310	90	216	29	91	7	91	3	88	0	43
CP76-351	CP77-407	91	117	0	22	0	24	0	27	.	.
CP76-351	CP77-407	92	240	11	56	3	67	.	.	.	.
CP76-351	CP80-323	91	90	6	69	1	55	0	27	.	.
CP76-351	CP83-607	92	221	0	23	0	25	.	.	.	.
CP76-351	CP87-618	90	209	12	48	5	84	3	89	1	94
CP76-351	LCP81-010	90	208	23	83	0	17	0	26	0	43
CP76-351	LCP85-336	91	237	0	22	0	24	0	27	.	.
CP76-351	LCP85-384	90	237	39	97	7	89	5	95	1	92
CP76-351	LCP86-402	90	238	1	6	0	17	0	26	0	43
CP76-351	LCP87-017	92	692	0	23	0	25	.	.	.	.
CP76-351	LCP88-091	90	242	18	62	1	42	0	26	0	43
CP76-351	L88-070	90	176	13	62	2	64	1	73	0	43
CP76-351	US77-010	90	163	20	88	0	17	0	26	0	43
CP77-310	CP75-1082	90	207	8	35	2	60	0	26	0	43
CP77-310	CP76-331	91	83	0	22	0	24	0	27	.	.
CP77-310	CP80-323	91	247	23	81	10	91	3	81	.	.
CP77-310	CP84-761	92	1304	0	23	0	25	.	.	.	.
CP77-310	L88-046	90	38	8	99	0	17	0	26	0	43
CP77-310	L89-098	91	202	0	22	0	24	0	27	.	.
CP77-310	91P4	91	193	3	46	0	24	0	27	.	.
CP77-310	92P6	92	245	11	54	2	60	.	.	.	.
CP77-405	CP85-803	90	218	13	52	3	68	2	80	0	43
CP77-405	HoCP85-845	91	444	0	22	0	24	0	27	.	.
CP77-405	LCP82-089	90	403	1	1	0	17	0	26	0	43
CP77-405	LCP82-089	91	455	0	22	0	24	0	27	.	.
CP77-405	LCP82-089	92	1541	0	23	0	25	.	.	.	.
CP77-405	LCP85-336	90	439	11	24	3	51	1	54	0	43
CP77-405	LCP85-384	90	406	10	24	0	17	0	26	0	43
CP77-405	L88-063	91	799	38	59	14	68	6	70	.	.
CP77-405	L90-200	92	461	0	23	0	25	.	.	.	.
CP77-405	90P1	90	62	7	84	1	70	0	26	0	43
CP77-405	90P4	90	211	1	12	0	17	0	26	0	43
CP77-405	91P5	91	223	0	22	0	24	0	27	.	.
CP77-407	LCP82-089	90	225	28	89	3	67	1	66	0	43
CP77-407	LCP87-017	92	859	0	23	0	25	.	.	.	.
CP77-407	87P3	93	198	0	20	.	.	.	.	.	.
CP77-407	90P1	90	245	18	60	8	92	6	96	0	43
CP77-407	92P5	92	477	0	23	0	25	.	.	.	.
CP77-407	92P6	92	452	37	67	5	66	.	.	.	.
CP78-317	CP76-331	90	221	23	80	7	90	4	94	0	43

Table 5. Continue

Female	Male	Cross Series	Survive ‡	1st Line no.	1st Line Rank pcnt'l	2nd Line no.	2nd Line Rank pcnt'l	Increase no.	Increase Rank pcnt'l	Assignment no.	Assignment Rank Pent'l
CP78-317	CP77-310	90	248	7	26	1	39	0	26	0	43
CP78-317	LCP85-336	91	256	0	22	0	24	0	27	.	.
CP78-317	LCP86-402	90	223	46	98	14	98	4	94	1	93
CP78-317	LCP86-454	91	235	24	87	7	81	4	86	.	.
CP78-317	LCP87-479	90	236	14	50	7	89	0	26	0	43
CP78-317	L90-190	92	729	117	91	16	76	.	.	.	.
CP78-317	US77-010	90	244	20	68	3	66	1	62	0	43
CP78-357	CP70-321	91	111	4	50	1	53	1	77	.	.
CP78-357	CP73-343	92	717	31	52	9	68	.	.	.	.
CP78-357	CP76-331	92	916	64	61	7	58	.	.	.	.
CP78-357	CP77-310	92	197	10	57	1	55	.	.	.	.
CP78-357	CP80-323	90	205	27	91	4	77	3	90	1	94
CP78-357	LCP81-010	90	422	41	76	7	71	4	82	1	90
CP78-357	LCP81-010	91	242	6	47	2	51	0	27	.	.
CP78-357	LCP81-010	93	500	20	49	.	.	.	.	.	.
CP78-357	LCP81-030	90	234	8	32	1	43	1	65	0	43
CP78-357	LCP82-089	92	239	39	93	11	90	.	.	.	.
CP78-357	LCP85-384	91	495	41	75	22	95	12	94	.	.
CP78-357	LCP86-454	92	250	21	68	12	92	.	.	.	.
CP78-357	LCP89-109	91	90	9	85	3	87	3	98	.	.
CP79-318	CP62-258	90	459	1	1	0	17	0	26	0	43
CP79-318	CP73-343	91	202	0	22	0	24	0	27	.	.
CP79-318	CP75-1082	91	230	0	22	0	24	0	27	.	.
CP79-318	CP80-323	91	102	21	99	10	99	5	99	.	.
CP79-318	CP89-855	93	449	20	53	.	.	.	.	.	.
CP79-318	LCP81-030	90	244	13	45	0	17	0	26	0	43
CP79-318	LCP82-089	91	1669	99	65	31	71	6	56	.	.
CP79-318	LCP85-384	91	928	72	73	12	62	6	69	.	.
CP79-318	LCP86-454	91	232	20	77	3	62	0	27	.	.
CP79-318	LHo92-307	93	387	20	55	.	.	.	.	.	.
CP79-318	L75-056	91	210	0	22	0	24	0	27	.	.
CP79-318	L88-063	93	657	48	46	.	.	.	.	.	.
CP79-318	L89-113	93	177	6	46	.	.	.	.	.	.
CP79-318	L89-124	91	249	0	22	0	24	0	27	.	.
CP79-318	L89-152	93	147	6	50	.	.	.	.	.	.
CP79-318	L90-178	93	170	0	20	.	.	.	.	.	.
CP79-318	L90-191	93	125	2	41	.	.	.	.	.	.
CP79-318	L92-353	93	181	0	20	.	.	.	.	.	.
CP79-318	US77-010	90	173	1	16	0	17	0	26	0	43
CP79-318	US90-021	93	189	17	64	.	.	.	.	.	.
CP79-318	91P5	91	203	0	22	0	24	0	27	.	.
CP79-332	CP57-614	93	173	0	20	.	.	.	.	.	.
CP79-332	CP76-331	91	90	0	22	0	24	0	27	.	.
CP79-332	LCP81-030	90	228	1	6	0	17	0	26	0	43
CP79-348	CP73-343	90	311	5	21	2	50	1	57	0	43
CP79-348	CP75-308	91	218	8	52	4	70	1	65	.	.
CP79-348	HoCP85-845	91	192	0	22	0	24	0	27	.	.
CP79-348	LCP81-030	90	465	1	1	0	17	0	26	0	43
CP79-348	LCP85-384	92	1198	128	80	44	83	.	.	.	.
CP79-348	LCP88-079	91	86	6	71	5	97	2	92	.	.
CP79-348	LCP88-091	91	249	0	22	0	24	0	27	.	.
CP80-323	LCP82-047	90	449	2	6	0	17	0	26	0	43
CP80-323	LCP85-384	91	1130	103	79	14	58	5	64	.	.
CP80-323	91P5	91	227	6	48	0	24	0	27	.	.
CP80-328	CP75-1082	93	510	0	20	.	.	.	.	.	.
CP80-328	L75-056	90	441	3	18	0	17	0	26	0	43

Table 5. Continue

Female	Male	Cross Series	Survive ‡	1st Line no.	1st Line Rank pcnt'l	2nd Line no.	2nd Line Rank pcnt'l	Increase no.	Increase Rank pcnt'l	Assignment no.	Assignment Rank Pent'l
CP80-328	L84-290	90	631	32	43	4	50	3	69	0	43
CP80-328	L84-290	91	173	9	62	2	56	0	27	.	.
CP80-329	CP76-351	91	67	0	22	0	24	0	27	.	.
CP80-329	CP77-310	90	232	1	6	0	17	0	26	0	43
CP80-351	LCP81-030	90	425	13	30	5	65	1	54	0	43
CP80-352	CP81-332	90	230	1	6	0	17	0	26	0	43
CP80-352	CP81-332	91	104	0	22	0	24	0	27	.	.
CP80-352	LCP82-047	91	148	23	97	0	24	0	27	.	.
CP80-352	L84-290	91	224	0	22	0	24	0	27	.	.
CP81-316	CP72-355	90	142	7	41	4	88	1	75	0	43
CP81-332	CP76-331	92	185	0	23	0	25	.	.	.	.
CP82-537	CP76-331	90	236	1	6	0	17	0	26	0	43
CP82-550	CP77-310	91	242	15	66	5	74	2	73	.	.
CP82-550	CP89-855	92	243	0	23	0	25	.	.	.	.
CP82-550	LCP82-089	90	735	77	80	6	55	3	61	0	43
CP82-550	LCP85-336	91	941	129	95	49	96	22	92	.	.
CP82-550	L90-190	92	731	90	85	15	74	.	.	.	.
CP83-644	CP57-614	90	474	42	72	11	82	2	65	2	92
CP83-644	CP70-330	91	240	18	73	3	59	2	74	.	.
CP83-644	CP74-383	91	732	0	22	0	24	0	27	.	.
CP83-644	CP74-383	93	177	30	85	.	.	.	.	.	.
CP83-644	CP77-310	90	453	42	74	1	35	1	53	1	88
CP83-644	HoCP85-845	91	477	31	68	11	76	1	55	.	.
CP83-644	LCP82-089	91	1167	105	78	44	89	25	89	.	.
CP83-644	LCP82-089	92	833	0	23	0	25	.	.	.	.
CP83-644	LCP85-384	92	1557	235	89	33	75	.	.	.	.
CP83-644	LCP86-393	91	237	0	22	0	24	0	27	.	.
CP83-644	LCP87-017	92	1076	179	95	48	93	.	.	.	.
CP83-644	LCP88-091	91	250	11	57	4	65	1	58	.	.
CP83-644	LCP88-091	92	247	37	88	14	96	.	.	.	.
CP83-644	L75-056	92	697	131	96	36	93	.	.	.	.
CP84-730	CP79-318	93	62	0	20	.	.	.	.	.	.
CP86-915	CP77-310	90	190	3	21	0	17	0	26	0	43
CP86-916	CP76-331	90	209	34	96	2	60	1	69	0	43
CP86-917	LCP81-030	90	199	1	12	0	17	0	26	0	43
CP86-933	CP86-933	90	151	6	36	0	17	0	26	0	43
CP86-974	CP72-370	90	249	11	40	3	65	2	76	0	43
CP86-974	CP79-318	90	190	10	45	0	17	0	26	0	43
CP86-974	LCP85-384	90	252	7	26	1	39	1	58	0	43
CP87-609	CP77-407	90	218	1	12	0	17	0	26	0	43
CP87-625	CP77-405	90	172	16	74	3	73	0	26	0	43
CP87-626	92P6	92	476	0	23	0	25	.	.	.	.
CP87-638	90P2	90	203	1	12	0	17	0	26	0	43
CP87-649	90P2	90	213	3	20	0	17	0	26	0	43
CP87-657	LCP82-089	93	369	68	88	.	.	.	.	.	.
CP87-657	91P4	91	87	0	22	0	24	0	27	.	.
CP87-658	CP87-658	92	107	0	23	0	25	.	.	.	.
CP87-658	LCP85-384	92	110	0	23	0	25	.	.	.	.
CP87-665	90P2	90	169	1	16	0	17	0	26	0	43
CP88-715	91P3	91	223	0	22	0	24	0	27	.	.
CP89-800	CP75-1082	93	252	6	44	.	.	.	.	.	.
CP89-800	CP77-405	93	205	17	61	.	.	.	.	.	.
CP89-800	LCP85-384	93	350	22	58	.	.	.	.	.	.
CP89-800	LHo92-307	93	222	0	20	.	.	.	.	.	.
CP89-800	L90-191	93	198	20	69	.	.	.	.	.	.
CP89-805	CP89-805	92	235	0	23	0	25	.	.	.	.

Table 5. Continue

Female	Male	Cross Series	Survive ‡	1st Line no.	1st Line Rank pcnt'l	2nd Line no.	2nd Line Rank pcnt'l	Increase no.	Increase Rank pcnt'l	Assignment no.	Assignment Rank Pcnt'l
CP89-831	LCP82-089	92	153	18	84	6	86	.	.	.	.
CP89-855	CP75-1082	93	245	0	20	.	.	.	.	.	.
CP89-855	93P5	93	218	20	65	.	.	.	.	.	.
CP89-855	93P6	93	200	26	78	.	.	.	.	.	.
CP89-874	91P3	91	96	13	94	1	55	1	79	.	.
CP89-879	LCP82-089	93	341	77	94	.	.	.	.	.	.
CP89-879	LCP85-384	93	372	58	83	.	.	.	.	.	.
CP89-879	LHo92-307	93	242	63	98	.	.	.	.	.	.
CP89-884	LCP82-089	92	236	0	23	0	25	.	.	.	.
CP90-941	93P1	93	91	0	20	.	.	.	.	.	.
CP91-516	LCP85-384	93	412	118	99	.	.	.	.	.	.
CP91-538	93P2	93	112	15	79	.	.	.	.	.	.
CP91-552	LCP87-017	93	1177	0	20	.	.	.	.	.	.
CP91-557	CP91-572	93	111	22	90	.	.	.	.	.	.
CP91-577	CP76-331	93	250	0	20	.	.	.	.	.	.
CP91-577	LCP82-089	93	762	28	49	.	.	.	.	.	.
HoCP85-845	CP75-1082	93	244	26	72	.	.	.	.	.	.
HoCP85-845	CP76-331	93	253	34	74	.	.	.	.	.	.
HoCP85-845	CP79-318	93	232	0	20	.	.	.	.	.	.
HoCP85-845	CP89-855	93	1810	82	52	.	.	.	.	.	.
HoCP85-845	CP91-534	93	347	0	20	.	.	.	.	.	.
HoCP85-845	HoCP85-845	90	243	6	24	2	55	0	26	0	43
HoCP85-845	LCP85-384	93	689	171	97	.	.	.	.	.	.
HoCP85-845	LCP86-454	93	168	0	20	.	.	.	.	.	.
HoCP85-845	LHo92-307	93	298	27	55	.	.	.	.	.	.
HoCP85-845	L88-063	93	218	15	59	.	.	.	.	.	.
HoCP85-845	L89-152	93	195	0	20	.	.	.	.	.	.
HoCP85-845	L90-178	93	325	0	20	.	.	.	.	.	.
HoCP85-845	L90-191	93	451	49	72	.	.	.	.	.	.
HoCP85-845	L91-261	93	193	0	20	.	.	.	.	.	.
HoCP85-845	US90-021	93	313	19	57	.	.	.	.	.	.
HoCP88-739	CP79-318	92	430	49	81	24	95	.	.	.	.
HoCP88-739	HoCP85-845	93	172	17	68	.	.	.	.	.	.
HoCP88-739	LCP82-089	93	130	27	90	.	.	.	.	.	.
HoCP88-739	LCP85-384	93	204	48	96	.	.	.	.	.	.
HoCP88-739	L88-063	93	222	55	97	.	.	.	.	.	.
HoCP88-769	LCP81-010	93	500	0	20	.	.	.	.	.	.
HoCP89-846	CP76-331	92	85	0	23	0	25	.	.	.	.
HoCP89-846	CP77-310	91	235	9	53	2	52	1	63	.	.
HoCP89-846	CP77-310	92	409	29	62	7	71	.	.	.	.
HoCP89-846	CP88-702	92	361	0	23	0	25	.	.	.	.
HoCP89-846	CP89-855	93	110	0	20	.	.	.	.	.	.
HoCP89-846	LCP81-010	93	253	22	63	.	.	.	.	.	.
HoCP89-846	LCP82-089	92	622	0	23	0	25	.	.	.	.
HoCP89-846	LCP85-384	92	746	123	94	31	88	.	.	.	.
HoCP89-846	LCP85-384	93	468	38	53	.	.	.	.	.	.
HoCP89-846	LCP86-454	93	652	0	20	.	.	.	.	.	.
HoCP89-846	LCP87-017	93	256	0	20	.	.	.	.	.	.
HoCP89-846	L75-056	92	316	28	73	6	52	.	.	.	.
HoCP89-846	L89-113	93	152	35	95	.	.	.	.	.	.
HoCP89-846	L89-152	93	222	0	20	.	.	.	.	.	.
HoCP89-846	US90-018	93	112	17	82	.	.	.	.	.	.
HoCP89-846	US90-027	93	213	6	45	.	.	.	.	.	.
HoCP90-957	LCP81-010	93	109	0	20	.	.	.	.	.	.
HoCP90-957	LCP86-454	93	255	0	20	.	.	.	.	.	.
CP89-884	CP91-558	93	216	20	66	.	.	.	.	.	.

Table 5. Continue

Female	Male	Cross Series	Survive ‡	1st Line no.	1st Line Rank pcnt'l	2nd Line no.	2nd Line Rank pcnt'l	Increase no.	Increase Rank pcnt'l	Assignment no.	Assignment Rank Pent'l
CP89-884	CP91-568	93	255	5	43	.	.	.	.	.	.
CP89-884	L91-255	93	109	2	42	.	.	.	.	.	.
Ho89-889	LCP85-384	92	1359	265	97	71	94	.	.	.	.
LCP81-005	CP62-258	90	202	6	29	4	77	1	71	0	43
LCP81-005	CP62-258	91	703	40	64	9	60	3	63	.	.
LCP81-005	CP74-2013	92	976	0	23	0	25	.	.	.	.
LCP81-005	CP74-2013	93	119	0	20	.	.	.	.	.	.
LCP81-005	LCP81-030	90	247	1	6	0	17	0	26	0	43
LCP81-010	CP72-355	91	90	6	69	3	87	2	91	.	.
LCP81-010	CP73-343	91	878	63	59	13	53	2	46	.	.
LCP81-010	CP73-343	93	246	28	75	.	.	.	.	.	.
LCP81-010	CP74-2013	91	80	0	22	0	24	0	27	.	.
LCP81-010	CP76-331	90	234	1	6	0	17	0	26	0	43
LCP81-010	CP76-331	93	994	17	42	.	.	.	.	.	.
LCP81-010	CP79-348	91	209	9	55	1	50	0	27	.	.
LCP81-010	HoCP85-845	90	230	14	53	1	43	0	26	0	43
LCP81-010	LCP81-030	91	884	38	58	12	63	6	71	.	.
LCP81-010	LCP82-089	91	1065	49	58	16	65	6	66	.	.
LCP81-010	LCP82-089	93	751	36	54	.	.	.	.	.	.
LCP81-010	LCP85-336	91	477	0	22	0	24	0	27	.	.
LCP81-010	LCP85-384	92	489	57	83	18	83	.	.	.	.
LCP81-010	LCP86-454	91	938	22	47	8	52	6	68	.	.
LCP81-010	L75-056	91	87	0	22	0	24	0	27	.	.
LCP81-010	L89-136	91	466	0	22	0	24	0	27	.	.
LCP81-010	92P6	92	442	19	52	4	63	.	.	.	.
LCP81-010	93P5	93	139	5	48	.	.	.	.	.	.
LCP81-015	LCP85-384	90	481	29	52	9	75	5	83	0	43
LCP81-015	LCP86-402	90	245	8	31	1	42	1	61	1	91
LCP81-015	LCP86-454	90	207	13	54	2	60	0	26	0	43
LCP81-015	L88-028	90	173	5	28	0	17	0	26	0	43
LCP81-030	CP72-370	90	817	74	73	14	72	6	75	1	86
LCP81-030	CP76-351	91	172	0	22	0	24	0	27	.	.
LCP81-030	LCP82-089	90	544	97	98	1	35	1	52	1	88
LCP81-030	LCP85-376	90	241	28	84	10	96	5	95	2	97
LCP81-030	LCP86-402	90	291	21	60	1	38	0	26	0	43
LCP81-030	LCP86-454	90	181	26	93	1	48	1	72	0	43
LCP81-030	LCP87-017	92	452	35	65	4	62	.	.	.	.
LCP81-030	90P1	90	222	6	25	0	17	0	26	0	43
LCP81-030	90P3	90	247	16	55	2	54	1	60	0	43
LCP81-030	92P5	92	111	0	23	0	25	.	.	.	.
LCP81-030	92P6	92	412	44	78	4	65	.	.	.	.
LCP82-046	LCP81-030	90	242	16	56	6	86	4	93	0	43
LCP82-046	LCP81-030	92	109	0	23	0	25	.	.	.	.
LCP82-047	CP69-1052	90	232	1	6	0	17	0	26	0	43
LCP82-089	CP76-331	92	920	82	70	1	50	.	.	.	.
LCP82-089	LCP81-010	93	424	35	61	.	.	.	.	.	.
LCP82-089	LCP82-089	90	197	1	12	0	17	0	26	0	43
LCP82-089	LCP85-384	93	765	0	20	.	.	.	.	.	.
LCP82-089	86P5	90	213	11	44	0	17	0	26	0	43
LCP82-089	93P4	93	251	0	20	.	.	.	.	.	.
LCP84-215	LCP81-030	90	235	1	6	0	17	0	26	0	43
LCP85-313	LCP82-089	93	679	92	80	.	.	.	.	.	.
LCP85-313	LCP85-384	93	162	0	20	.	.	.	.	.	.
LCP85-313	L90-178	93	224	38	86	.	.	.	.	.	.
LCP85-336	CP76-331	90	378	12	30	0	17	0	26	0	43
LCP85-336	CP77-407	90	164	24	93	0	17	0	26	0	43

Table 5. Continue

Female	Male	Cross Series	Survive ‡	1st Line no.	1st Line Rank pcnt'l	2nd Line no.	2nd Line Rank pcnt'l	Increase no.	Increase Rank pcnt'l	Assignment no.	Assignment Rank Pent'l
LCP85-336	CP77-407	93	578	0	20	.	.	.	.	.	.
LCP85-336	LCP81-030	90	369	25	58	4	63	0	26	0	43
LCP85-336	LCP85-336	90	190	2	19	0	17	0	26	0	43
LCP85-336	90P3	90	453	29	54	5	59	4	77	1	68
LCP85-336	90P3	93	134	0	20	.	.	.	.	.	.
LCP85-336	90P4	90	190	2	19	0	17	0	26	0	43
LCP85-336	91P5	91	225	0	22	0	24	0	27	.	.
LCP85-376	CP78-317	90	405	47	84	4	61	1	56	0	43
LCP85-384	CP74-383	91	970	150	97	62	98	39	98	.	.
LCP85-384	CP75-1082	90	304	13	38	7	81	4	86	0	43
LCP85-384	CP75-1082	93	244	10	50	.	.	.	.	.	.
LCP85-384	CP78-317	91	173	0	22	0	24	0	27	.	.
LCP85-384	CP80-313	90	430	33	64	9	80	5	84	1	89
LCP85-384	CP89-855	93	961	0	20	.	.	.	.	.	.
LCP85-384	CP90-963	93	498	0	20	.	.	.	.	.	.
LCP85-384	HoCP85-845	91	96	11	92	3	84	2	88	.	.
LCP85-384	LCP81-010	90	823	28	32	6	52	2	55	0	43
LCP85-384	LCP81-010	91	233	13	63	6	80	5	89	.	.
LCP85-384	LCP82-089	93	1468	150	70	.	.	.	.	.	.
LCP85-384	LCP85-336	90	1154	68	50	11	59	7	74	3	90
LCP85-384	LCP85-336	91	885	0	22	0	24	0	27	.	.
LCP85-384	LCP85-384	93	111	0	20	.	.	.	.	.	.
LCP85-384	LCP86-454	91	78	11	95	3	90	1	83	.	.
LCP85-384	LCP87-496	91	454	33	72	8	68	4	76	.	.
LCP85-384	L75-056	93	358	75	91	.	.	.	.	.	.
LCP85-384	L88-046	91	242	9	52	3	58	3	82	.	.
LCP85-384	L89-120	91	232	0	22	0	24	0	27	.	.
LCP85-384	90P4	90	203	24	85	8	94	3	90	0	43
LCP85-384	91P5	91	234	20	76	9	90	5	88	.	.
LCP85-384	92P4	92	970	104	78	29	79	.	.	.	.
LCP85-384	92P9	92	439	0	23	0	25	.	.	.	.
LCP85-384	93P6	93	368	0	20	.	.	.	.	.	.
LCP86-393	CP77-310	90	422	15	33	8	76	4	82	1	90
LCP86-408	CP70-321	90	713	68	75	22	90	9	85	1	87
LCP86-408	CP77-310	90	303	15	42	1	37	0	26	0	43
LCP86-408	CP80-323	90	341	18	45	4	64	0	26	0	43
LCP86-408	LCP82-089	91	208	23	90	9	94	4	87	.	.
LCP86-408	LCP85-384	90	750	61	67	8	63	3	60	0	43
LCP86-408	LCP85-384	91	973	98	86	31	86	21	91	.	.
LCP86-420	LCP81-030	90	125	7	47	1	54	1	76	0	43
LCP86-420	L78-063	90	309	18	49	4	66	2	74	2	96
LCP86-422	CP77-407	91	113	13	92	2	69	1	76	.	.
LCP86-422	CP77-407	93	622	131	92	.	.	.	.	.	.
LCP86-429	CP70-321	91	249	23	80	6	78	2	71	.	.
LCP86-429	CP72-370	90	278	12	38	0	17	0	26	0	43
LCP86-429	CP75-1082	90	213	12	47	4	76	1	68	0	43
LCP86-429	CP75-1082	93	246	25	70	.	.	.	.	.	.
LCP86-429	CP75-361	91	469	44	82	9	72	3	68	.	.
LCP86-429	CP76-331	90	148	1	18	0	17	0	26	0	43
LCP86-429	CP77-310	90	151	16	81	5	92	4	96	0	43
LCP86-429	CP77-310	91	254	25	83	8	84	1	57	.	.
LCP86-429	CP77-405	90	414	22	45	2	46	0	26	0	43
LCP86-429	CP77-405	92	204	0	23	0	25	.	.	.	.
LCP86-429	CP77-407	91	98	9	80	3	83	1	79	.	.
LCP86-429	CP78-317	90	386	38	77	9	83	1	56	0	43
LCP86-429	CP80-323	91	451	45	85	8	69	1	56	.	.

Table 5. Continue

Female	Male	Cross Series	Survive ‡	1st Line no.	1st Line Rank pcnt'l	2nd Line no.	2nd Line Rank pcnt'l	Increase no.	Increase Rank pcnt'l	Assignment no.	Assignment Rank Pent'l
LCP86-429	CP85-830	90	180	28	94	1	49	0	26	0	43
LCP86-429	CP88-718	91	247	0	22	0	24	0	27	.	.
LCP86-429	CP89-855	93	254	0	20	.	.	.	.	.	.
LCP86-429	HoCP85-845	91	240	0	22	0	24	0	27	.	.
LCP86-429	LCP81-010	90	447	44	77	9	78	1	53	0	43
LCP86-429	LCP81-030	90	372	39	80	8	81	3	77	0	43
LCP86-429	LCP81-030	92	672	0	23	0	25	.	.	.	.
LCP86-429	LCP82-089	93	735	82	74	.	.	.	.	.	.
LCP86-429	LCP85-336	90	955	73	63	16	71	11	84	0	43
LCP86-429	LCP85-384	90	742	67	72	31	96	21	97	7	98
LCP86-429	LCP86-395	90	212	13	53	3	68	2	81	1	93
LCP86-429	LCP86-402	90	193	23	86	3	70	2	83	1	95
LCP86-429	LCP86-429	92	.	12	.	1	.	.	.	.	.
LCP86-429	LCP86-454	91	472	39	75	15	85	7	85	.	.
LCP86-429	LCP87-017	93	254	22	63	.	.	.	.	.	.
LCP86-429	LCP87-496	90	243	25	79	1	42	1	63	0	43
LCP86-429	L75-056	93	238	0	20	.	.	.	.	.	.
LCP86-429	L78-063	90	357	1	2	0	17	0	26	0	43
LCP86-429	L88-063	90	197	24	87	13	98	7	98	3	99
LCP86-429	L89-120	91	246	10	55	4	67	2	72	.	.
LCP86-429	L90-190	92	73	5	60	0	25	.	.	.	.
LCP86-429	91P3	91	250	16	67	5	72	1	58	.	.
LCP86-454	CP76-331	93	748	0	20	.	.	.	.	.	.
LCP86-454	CP87-626	91	667	0	22	0	24	0	27	.	.
LCP86-454	CP89-855	93	181	0	20	.	.	.	.	.	.
LCP86-454	LCP81-010	93	211	34	85	.	.	.	.	.	.
LCP86-454	LCP82-089	93	253	0	20	.	.	.	.	.	.
LCP86-454	LCP85-384	93	2246	244	71	.	.	.	.	.	.
LCP86-454	L89-113	93	357	46	77	.	.	.	.	.	.
LCP86-454	92P4	92	217	22	74	2	64	.	.	.	.
LCP86-496	CP77-407	90	215	9	37	2	58	0	26	0	43
LCP87-017	CP70-321	91	473	18	53	10	75	2	62	.	.
LCP87-017	CP76-331	90	124	16	90	0	17	0	26	0	43
LCP87-017	CP76-331	91	724	0	22	0	24	0	27	.	.
LCP87-017	CP76-331	93	200	0	20	.	.	.	.	.	.
LCP87-017	CP87-667	90	389	42	83	3	53	0	26	0	43
LCP87-017	CP87-667	92	464	15	48	4	61	.	.	.	.
LCP87-017	CP89-855	93	492	0	20	.	.	.	.	.	.
LCP87-017	LCP85-384	91	232	0	22	0	24	0	27	.	.
LCP87-017	LCP85-384	93	329	0	20	.	.	.	.	.	.
LCP87-017	LCP87-472	90	252	7	26	1	39	0	26	0	43
LCP87-017	L88-063	93	190	0	20	.	.	.	.	.	.
LCP87-017	L89-097	91	175	0	22	0	24	0	27	.	.
LCP87-017	US78-026	90	208	3	20	1	46	1	70	0	43
LCP87-017	91P1	91	248	0	22	0	24	0	27	.	.
LCP87-017	92P1	92	458	0	23	0	25	.	.	.	.
LCP87-023	LCP81-010	91	248	11	57	3	57	0	27	.	.
LCP87-023	LCP81-030	90	239	14	50	0	17	0	26	0	43
LCP87-023	90P2	90	233	6	25	2	56	0	26	0	43
LCP87-472	CP78-317	91	701	49	71	7	54	5	69	.	.
LCP87-492	CP77-405	90	75	8	82	0	17	0	26	0	43
LCP87-492	LCP85-384	90	146	19	90	6	95	2	88	0	43
LCP87-492	LCP85-384	91	583	60	88	16	81	14	93	.	.
LCP87-494	90P4	90	243	26	82	10	95	7	97	0	43
LCP87-496	CP76-331	90	522	17	31	0	17	0	26	0	43
LCP87-496	L89-136	91	632	62	83	15	77	6	78	.	.

Table 5. Continue

Female	Male	Cross Series	Survive ‡	1st Line no.	1st Line Rank pcnt'l	2nd Line no.	2nd Line Rank pcnt'l	Increase no.	Increase Rank pcnt'l	Assignment no.	Assignment Rank Pent'l
LCP87-496	91P4	91	101	3	49	0	24	0	27	.	.
LCP88-091	CP89-816	92	107	0	23	0	25	.	.	.	.
LCP88-091	LCP88-091	90	105	2	22	1	59	0	26	0	43
LHo83-153	LCP82-089	92	208	20	72	4	73	.	.	.	.
LHo83-153	LCP82-089	93	134	13	68	.	.	.	.	.	.
LHo83-153	92P9	92	327	0	23	0	25	.	.	.	.
L75-002	LCP87-017	92	637	65	75	9	70	.	.	.	.
L75-056	LCP82-089	93	203	31	83	.	.	.	.	.	.
L75-056	93P5	93	106	14	78	.	.	.	.	.	.
L78-063	90P1	90	245	30	87	6	85	2	78	0	43
L78-063	92P3	92	327	0	23	0	25	.	.	.	.
L78-063	92P4	92	498	36	63	1	51	.	.	.	.
L78-063	92P5	92	375	0	23	0	25	.	.	.	.
L82-107	CP69-373	90	229	9	35	0	17	0	26	0	43
L84-290	CP83-644	93	222	0	20	.	.	.	.	.	.
L88-028	LCP81-030	91	248	0	22	0	24	0	27	.	.
L88-028	91P4	91	97	0	22	0	24	0	27	.	.
L88-030	CP75-1082	91	66	0	22	0	24	0	27	.	.
L88-030	CP77-310	91	241	3	45	1	49	1	60	.	.
L88-030	LCP81-030	90	248	1	6	0	17	0	26	0	43
L88-059	CP75-1082	90	235	1	6	0	17	0	26	0	43
L88-060	LCP87-472	90	201	10	42	3	69	0	26	0	43
L88-069	CP87-662	90	200	16	67	3	69	0	26	0	43
L88-072	90P1	90	142	18	89	5	93	2	89	1	97
L88-073	CP75-1082	91	251	0	22	0	24	0	27	.	.
L88-073	LCP87-472	91	832	42	60	10	56	5	66	.	.
L88-075	91P4	91	238	2	44	2	52	2	75	.	.
L89-101	CP77-310	91	212	0	22	0	24	0	27	.	.
L89-110	CP76-331	91	245	0	22	0	24	0	27	.	.
L89-110	LCP85-336	91	69	0	22	0	24	0	27	.	.
L89-113	LCP85-384	91	1105	103	81	47	93	30	96	.	.
L89-113	92P5	92	206	28	86	5	77	.	.	.	.
L89-115	CP77-310	91	113	5	57	0	24	0	27	.	.
L89-115	LCP85-384	91	296	0	22	0	24	0	27	.	.
L89-116	CP76-331	91	164	0	22	0	24	0	27	.	.
L89-118	CP78-317	91	248	20	74	5	73	3	80	.	.
L89-118	LCP86-454	91	774	0	22	0	24	0	27	.	.
L89-121	CP77-407	91	186	0	22	0	24	0	27	.	.
L89-134	CP76-331	91	235	0	22	0	24	0	27	.	.
L89-134	LCP85-384	91	230	23	85	13	97	6	95	.	.
L89-140	91P4	91	248	8	50	4	66	1	59	.	.
L89-152	CP76-331	91	131	4	49	0	24	0	27	.	.
L89-152	LCP85-384	91	817	0	22	0	24	0	27	.	.
L89-163	CP76-331	91	99	11	90	3	82	0	27	.	.
L89-163	LCP85-384	91	1187	81	70	39	86	19	85	.	.
L90-170	CP77-310	92	251	0	23	0	25	.	.	.	.
L90-178	CP77-405	93	129	11	62	.	.	.	.	.	.
L90-178	CP79-318	92	101	0	23	0	25	.	.	.	.
L90-178	CP89-855	93	735	31	51	.	.	.	.	.	.
L90-178	LCP81-010	93	513	46	64	.	.	.	.	.	.
L90-178	LCP82-089	93	249	0	20	.	.	.	.	.	.
L90-178	LCP85-384	92	672	35	58	12	72	.	.	.	.
L90-178	L75-056	93	196	25	77	.	.	.	.	.	.
L90-178	93P6	93	170	0	20	.	.	.	.	.	.
L90-190	92P1	92	216	7	48	1	54	.	.	.	.
L90-191	CP76-331	92	467	0	23	0	25	.	.	.	.

Table 5. Continue

Female	Male	Cross Series	Survive ‡	1st Line		2nd Line		Increase		Assignment	
				no.	Rank pcnt'l	no.	Rank pcnt'l	no.	Rank pcnt'l	no.	Rank Pent'l
L90-191	CP87-626	92	700	0	23	0	25	.	.	.	.
L90-191	CP89-855	93	195	27	81	.	.	.	.	.	.
L90-191	LCP85-384	93	734	106	81	.	.	.	.	.	.
L90-200	92P5	92	108	0	23	0	25	.	.	.	.
L90-207	LCP85-384	92	95	9	71	7	98	.	.	.	.
L90-216	CP76-331	92	453	0	23	0	25	.	.	.	.
L90-216	US80-004	92	549	36	59	3	56	.	.	.	.
L91-230	CP76-331	93	255	0	20	.	.	.	.	.	.
L91-255	CP91-525	93	227	12	56	.	.	.	.	.	.
L91-255	US90-018	93	248	45	88	.	.	.	.	.	.
L91-281	CP91-558	93	230	22	67	.	.	.	.	.	.
L91-281	CP91-568	93	110	4	48	.	.	.	.	.	.
L91-281	L91-255	93	211	45	93	.	.	.	.	.	.
L91-286	CP76-331	93	220	10	53	.	.	.	.	.	.
L91-288	LCP82-089	93	751	0	20	.	.	.	.	.	.
L91-288	L91-255	93	249	0	20	.	.	.	.	.	.
L91-288	93P3	93	111	5	53	.	.	.	.	.	.
L91-290	CP89-855	93	251	0	20	.	.	.	.	.	.
US77-010	US77-010	90	168	15	72	4	84	0	26	0	43
US77-010	92P6	92	221	10	54	3	69	.	.	.	.
US77-017	CP62-258	93	506	21	51	.	.	.	.	.	.
US77-017	CP72-356	90	167	1	16	0	17	0	26	0	43
US77-017	CP76-331	93	183	0	20	.	.	.	.	.	.
US77-017	LCP85-336	93	397	0	20	.	.	.	.	.	.
US77-017	LCP85-384	93	155	17	73	.	.	.	.	.	.
US77-017	LHo92-307	93	159	0	20	.	.	.	.	.	.
US77-017	L90-191	93	148	31	91	.	.	.	.	.	.
US77-017	L91-261	93	146	33	94	.	.	.	.	.	.
US77-017	US90-021	93	235	27	75	.	.	.	.	.	.
US78-026	LCP87-017	91	501	7	46	3	50	2	57	.	.
US78-026	90P3	90	223	9	36	0	17	0	26	0	43
US78-026	91P4	91	188	7	52	0	24	0	27	.	.
US78-026	92P1	92	492	40	66	3	57	.	.	.	.
US78-026	92P3	92	456	0	23	0	25	.	.	.	.
US78-026	92P6	92	454	12	47	0	25	.	.	.	.
US78-026	92P7	92	423	3	46	0	25	.	.	.	.
US80-004	LCP85-384	91	205	17	75	7	88	5	94	.	.
US86-002	LCP85-384	90	180	8	40	1	49	1	72	0	43
US90-018	LCP85-384	93	196	31	84	.	.	.	.	.	.
US90-021	LCP85-384	93	792	60	47	.	.	.	.	.	.
US90-026	CP91-525	93	253	0	20	.	.	.	.	.	.
US90-026	CP91-568	93	229	3	40	.	.	.	.	.	.
US90-026	LCP85-384	93	144	7	55	.	.	.	.	.	.
US90-027	CP91-558	93	108	0	20	.	.	.	.	.	.

† Rank percentiles are based upon ranks within a cross series.

‡ Survive - is the number of clones surviving transplanting; 1st line - is the first clonal stage; 2nd line is the second clonal stage; Increase - is the first replicated clonal stage after the 2nd line stage; Assignment - is the stage after the Increase stage when clones are given their number designation and then planted into the Nursery stage.

Table 6. First ratoon families means and rank percentiles of cane yield components (plant weight) from the 1993 crossing series measured in August 1995 at the St. Gabriel Research Station.

Female	Male	Plant wt.		Stalks per plant		Stalk wt.		Stalk length		Stalk diam.	
		mean	pcnt'l	mean	pcnt'l	mean	pcnt'l	mean	pcnt'l	mean	pcnt'l
		kg		no.		kg		cm		cm	
CP65-357	CP78-2114	6.8	96	9.6	65	0.73	96	139	40	2.50	98
CP65-357	CP82-2043	8.0	98	10.9	93	0.76	97	149	58	2.50	98
CP65-357	L88-063	4.8	57	9.4	60	0.51	45	164	87	1.90	14
CP70-321	CP80-323	4.2	31	8.6	31	0.49	36	133	29	2.05	49
CP70-321	LCP82-089	4.7	56	9.7	68	0.49	40	158	76	1.98	29
CP70-321	LCP85-384	5.7	85	10.4	82	0.56	69	170	93	1.98	29
CP70-330	CP71-1240	4.3	36	6.6	3	0.66	94	144	49	2.35	94
CP71-382	CP71-1240	5.0	66	8.2	22	0.61	83	139	40	2.30	92
CP72-355	CP77-310	5.1	69	8.2	23	0.61	85	150	60	2.20	80
CP72-370	CP90-963	4.0	24	7.6	14	0.54	60	136	34	2.15	72
CP75-1082	93P5	2.8	4	6.4	2	0.43	19	122	13	2.03	41
CP76-331	CP90-963	3.8	17	9.7	69	0.40	10	114	7	2.13	67
CP76-331	HoCP85-845	4.3	38	8.7	35	0.51	47	130	24	2.15	72
CP76-331	L75-056	4.1	30	8.3	25	0.50	45	156	71	2.00	34
CP76-331	US90-027	3.6	13	9.1	50	0.40	11	126	17	1.95	25
CP76-331	93P4	3.0	5	6.5	2	0.46	27	118	10	2.20	83
CP76-331	93P5	4.7	50	7.6	14	0.61	85	138	36	2.35	94
CP78-357	LCP81-010	5.7	84	9.1	51	0.61	83	167	90	2.10	62
CP79-318	CP89-855	4.1	27	8.8	36	0.48	34	148	55	2.03	41
CP79-318	LHo92-307	4.3	33	10.2	81	0.42	16	151	61	1.80	3
CP79-318	L88-063	4.7	53	9.1	47	0.51	49	149	58	2.04	45
CP79-318	L89-113	4.4	41	9.1	48	0.49	40	166	89	1.90	14
CP79-318	L89-152	5.1	70	9.7	71	0.53	58	145	51	2.13	67
CP79-318	L90-191	5.7	83	9.2	54	0.61	86	168	91	2.05	49
CP79-318	US90-021	4.1	25	8.8	37	0.46	28	154	67	1.90	14
CP79-332	CP57-614	4.1	25	7.3	9	0.56	69	155	69	2.08	56
CP79-348	CP78-2114	6.0	89	9.2	53	0.65	92	133	30	2.45	97
CP80-328	CP75-1082	3.6	13	7.6	12	0.48	35	119	11	2.05	49
CP85-806	CP82-2043	5.8	87	9.8	73	0.64	90	160	81	2.20	80
CP87-657	LCP82-089	4.9	62	9.8	74	0.51	46	160	80	1.95	22
CP88-702	CP84-1198	6.6	94	10.4	82	0.64	90	143	47	2.30	92
CP88-702	HoCP85-845	4.3	35	9.0	43	0.48	35	132	28	2.10	62
CP88-702	LCP85-384	6.6	93	10.8	89	0.61	85	145	51	2.30	92
CP88-739	HoCP85-845	6.7	94	9.7	71	0.69	96	178	97	2.15	72
CP88-739	LCP82-089	5.9	87	10.8	90	0.55	64	155	69	2.03	41
CP88-739	LCP85-384	5.9	88	11.1	94	0.53	58	168	91	1.95	22
CP88-739	LCP87-017	5.4	78	9.8	73	0.54	62	165	88	2.00	34
CP88-769	LCP81-010	1.9	1	7.9	18	0.24	0	95	0	1.70	0
CP89-800	CP75-1082	3.0	6	9.0	41	0.33	4	101	2	1.95	25

Table 6. Continue.

Female	Male	Plant wt.		Stalks per plant		Stalk wt.		Stalk length		Stalk diam.	
		mean	pcnt'l	mean	pcnt'l	mean	pcnt'l	mean	pcnt'l	mean	pcnt'l
		kg		no.		kg		cm		cm	
CP89-800	CP77-405	3.2	9	7.7	17	0.42	16	125	15	2.03	41
CP89-800	CP91-534	5.8	86	9.8	73	0.59	77	162	85	2.10	62
CP89-800	LCP85-384	4.7	56	8.4	27	0.56	68	155	68	2.05	49
CP89-800	L90-191	3.1	7	8.1	20	0.38	8	115	8	1.95	25
CP89-816	CP78-2114	4.9	64	10.5	86	0.47	33	126	17	2.15	72
CP89-816	CP90-963	3.8	18	9.0	41	0.43	20	113	6	2.10	62
CP89-816	LCP86-454	4.6	45	6.9	5	0.66	94	134	32	2.40	96
CP89-831	CP82-2043	4.6	48	8.5	28	0.54	60	115	8	2.20	83
CP89-831	CP84-1198	5.5	81	8.3	25	0.68	95	129	22	2.55	99
CP89-831	HoCP85-845	5.0	67	8.5	29	0.59	79	147	54	2.25	87
CP89-831	LCP85-384	5.3	73	9.4	60	0.57	71	131	26	2.30	92
CP89-855	CP75-1082	3.2	10	7.1	7	0.45	25	135	33	2.03	41
CP89-855	CP88-702	5.9	89	9.1	50	0.65	92	148	56	2.30	92
CP89-855	CP88-764	5.1	70	10.0	76	0.52	49	130	24	2.25	87
CP89-855	93P5	1.5	0	3.7	0	0.35	5	97	1	1.90	14
CP89-855	93P6	4.7	50	13.2	99	0.35	6	129	22	1.85	8
CP89-879	LCP82-089	6.5	91	10.8	91	0.59	79	174	96	2.03	41
CP89-879	LCP85-384	5.2	72	11.5	96	0.45	26	173	96	1.78	1
CP89-879	LHo92-307	5.2	71	8.8	37	0.58	72	165	88	2.05	49
CP89-884	CP83-632	2.8	4	6.8	4	0.42	15	142	45	1.90	14
CP89-884	CP90-963	3.0	5	8.7	33	0.34	4	111	6	1.90	14
CP90-923	CP83-632	4.7	52	9.4	59	0.50	44	126	17	2.20	83
CP90-923	LCP83-165	4.1	26	6.9	4	0.60	81	167	90	2.10	62
CP90-923	LCP86-454	3.5	12	9.5	63	0.38	9	140	42	1.85	8
CP90-935	CP89-855	3.5	11	9.1	46	0.39	10	109	4	2.10	62
CP90-941	L91-255	4.4	39	6.9	5	0.63	89	135	33	2.40	96
CP90-941	93P1	4.0	22	9.1	48	0.44	22	129	20	2.03	41
CP90-951	CP90-963	5.7	83	9.7	69	0.59	77	153	65	2.15	72
CP90-952	L91-232	4.9	63	10.4	85	0.47	32	144	48	1.98	29
CP90-952	L91-264	5.3	73	9.3	56	0.58	74	158	78	2.10	62
CP90-956	93P2	3.8	19	8.3	26	0.44	24	129	22	2.00	34
CP90-957	LCP81-010	4.4	40	8.8	39	0.49	42	125	16	2.13	68
CP90-957	LCP86-454	4.0	22	8.8	36	0.44	22	117	10	2.10	62
CP90-962	LCP86-454	4.8	61	9.3	56	0.54	60	155	69	2.05	49
CP90-963	93P4	4.7	55	8.6	30	0.56	68	142	45	2.18	78
CP91-505	US90-018	3.7	17	8.8	39	0.42	17	136	34	1.97	27
CP91-516	LCP85-384	5.5	80	10.5	86	0.53	55	147	54	2.05	49
CP91-538	93P2	4.3	34	8.3	25	0.52	52	157	74	2.03	41
CP91-552	LCP87-017	3.6	15	10.9	93	0.33	4	121	12	1.85	8
CP91-557	CP91-572	5.6	82	9.3	57	0.58	75	158	78	2.10	62

Table 6. Continue.

Female	Male	Plant wt.		Stalks per plant		Stalk wt.		Stalk length		Stalk diam.	
		mean	pcnt'l	mean	pcnt'l	mean	pcnt'l	mean	pcnt'l	mean	pcnt'l
		kg		no.		kg		cm		cm	
CP91-577	CP76-331	3.9	20	7.3	9	0.53	55	119	11	2.25	87
CP91-577	LCP82-089	5.4	77	10.0	76	0.54	62	134	32	2.25	87
HoCP85-845	CP75-1082	4.7	54	6.5	3	0.73	97	165	88	2.33	94
HoCP85-845	CP76-331	4.7	51	8.5	28	0.55	67	154	67	2.10	62
HoCP85-845	CP79-318	4.4	41	8.6	31	0.51	48	145	51	2.08	56
HoCP85-845	CP89-855	4.6	47	9.1	47	0.50	43	144	49	2.00	34
HoCP85-845	CP91-534	4.4	40	9.7	67	0.47	29	152	64	1.95	22
HoCP85-845	LCP85-384	8.8	99	12.4	98	0.66	94	163	86	2.15	72
HoCP85-845	LCP86-454	4.1	28	7.6	13	0.54	63	137	35	2.18	78
HoCP85-845	LHo92-307	4.8	60	9.2	54	0.52	51	157	74	1.99	31
HoCP85-845	L90-178	4.3	34	9.2	52	0.47	31	161	82	1.88	10
HoCP85-845	L90-191	5.3	74	10.4	84	0.50	45	151	62	2.00	34
HoCP85-845	US90-021	6.6	93	12.3	98	0.49	41	139	37	2.08	54
HoCP89-846	CP75-1082	4.7	49	8.1	20	0.59	78	154	67	2.18	78
HoCP89-846	CP83-632	5.4	75	9.3	55	0.58	76	151	62	2.20	80
HoCP89-846	CP89-855	4.3	37	9.5	65	0.47	30	150	60	1.93	21
HoCP89-846	LCP81-010	7.2	97	9.2	52	0.78	98	184	98	2.28	90
HoCP89-846	LCP85-384	4.6	46	8.2	21	0.58	73	142	45	2.20	83
HoCP89-846	LCP86-454	3.9	21	7.5	12	0.53	59	153	65	2.03	41
HoCP89-846	LCP87-017	3.5	12	7.4	10	0.46	29	155	71	1.90	14
HoCP89-846	L89-113	4.7	52	10.0	77	0.47	31	156	71	1.90	14
HoCP89-846	L89-152	4.3	36	8.6	32	0.51	48	148	55	2.00	34
HoCP89-846	US90-018	5.4	78	9.5	64	0.56	71	157	75	2.10	62
HoCP89-846	US90-027	4.9	62	10.1	79	0.49	38	152	64	2.00	34
CP89-884	CP91-558	4.4	39	7.5	11	0.58	76	139	40	2.25	87
CP89-884	CP91-568	4.7	57	10.3	81	0.46	27	123	14	2.15	72
CP89-884	L91-255	4.8	59	10.7	88	0.45	25	137	36	1.90	14
LCP81-010	CP73-343	7.5	98	11.7	97	0.63	88	161	82	2.18	78
LCP81-010	CP76-331	3.6	14	7.7	16	0.49	37	110	5	2.30	92
LCP81-010	LCP82-089	5.0	65	9.5	63	0.53	55	132	28	2.15	72
LCP81-010	93P5	6.8	95	10.6	88	0.65	92	172	95	2.15	72
LCP82-089	LCP85-384	3.8	19	8.7	35	0.44	24	142	44	1.90	14
LCP82-089	93P4	2.0	2	7.2	8	0.29	1	102	3	1.83	5
LCP85-313	LCP82-089	4.9	64	10.4	85	0.47	33	155	69	1.95	22
LCP85-384	CP75-1082	4.8	58	7.9	19	0.60	81	133	31	2.23	85
LCP85-384	CP89-855	3.3	10	9.6	66	0.36	6	116	9	1.80	3
LCP85-384	CP90-963	3.1	8	9.9	74	0.32	3	108	3	1.90	14
LCP85-384	LCP85-384	2.0	2	6.4	1	0.29	1	100	1	1.78	1
LCP85-384	LCP87-017	5.4	79	8.9	40	0.61	84	175	97	2.10	62
LCP85-384	L75-056	5.4	79	10.1	78	0.55	67	159	79	2.05	49

Table 6. Continue.

Female	Male	Plant wt.		Stalks per plant		Stalk wt.		Stalk length		Stalk diam.	
		mean	pcnt'l	mean	pcnt'l	mean	pcnt'l	mean	pcnt'l	mean	pcnt'l
		kg		no.		kg		cm		cm	
LCP85-384	93P6	4.3	37	10.5	87	0.41	14	147	53	1.85	8
LCP86-408	CP90-963	5.4	77	10.2	80	0.53	55	128	20	2.20	80
LCP86-422	CP77-407	4.8	60	7.8	18	0.62	87	171	94	2.08	56
LCP86-429	CP75-1082	5.8	86	9.0	42	0.64	89	158	76	2.25	87
LCP86-429	CP77-407	4.2	31	10.2	80	0.41	14	131	25	1.93	20
LCP86-429	CP89-855	4.5	42	9.4	60	0.48	34	131	26	2.15	72
LCP86-429	LCP87-017	5.5	80	11.1	95	0.50	43	121	13	2.20	83
LCP86-454	CP76-331	4.1	29	8.0	19	0.53	55	131	26	2.15	72
LCP86-454	CP89-855	3.2	8	7.6	13	0.41	13	124	14	2.00	34
LCP86-454	LCP82-089	4.5	44	7.5	11	0.60	82	145	50	2.27	89
LCP86-454	LCP85-384	4.8	59	9.0	45	0.53	54	150	60	2.05	49
LCP86-454	L89-113	6.9	97	10.8	90	0.62	87	151	61	2.15	72
LCP87-017	CP76-331	4.2	32	8.7	34	0.49	36	143	47	2.05	49
LCP87-017	CP90-963	3.6	16	7.2	8	0.51	47	129	21	2.10	62
LCP87-017	LCP85-384	4.6	49	10.9	92	0.43	19	139	37	1.90	14
LCP87-017	L88-063	3.7	16	8.5	29	0.44	21	139	40	2.00	36
LCP87-496	LCP87-496	4.1	29	9.7	67	0.43	20	145	51	1.95	25
LHo83-153	CP88-702	3.8	18	9.1	50	0.40	11	116	9	1.90	14
LHo83-153	HoCP85-845	2.6	3	7.1	6	0.37	8	111	6	1.85	8
LHo83-153	LCP82-089	5.1	68	9.2	52	0.55	64	160	81	2.08	56
L75-056	CP76-331	4.5	43	9.4	59	0.49	39	137	35	2.05	49
L75-056	CP89-855	2.8	3	7.0	6	0.41	12	133	30	1.90	14
L75-056	93P5	5.0	66	8.9	40	0.58	75	158	76	2.08	54
L88-063	CP83-632	4.3	33	8.2	22	0.53	52	130	24	2.20	80
L88-063	CP88-702	3.6	14	9.0	43	0.40	12	121	12	1.90	14
L90-178	CP75-1082	4.9	65	10.4	82	0.46	27	128	20	2.05	49
L90-178	CP77-405	5.6	82	9.0	45	0.64	90	163	86	2.15	72
L90-178	CP89-855	6.2	90	10.4	84	0.61	82	157	73	2.15	72
L90-178	LCP81-010	5.0	67	9.0	43	0.53	55	125	15	2.10	62
L90-178	LCP82-089	4.6	45	8.5	27	0.54	63	169	93	1.93	20
L90-178	LCP87-017	4.5	43	9.0	45	0.49	41	152	64	1.95	22
L90-178	L75-056	4.8	58	9.4	59	0.52	50	160	81	1.98	29
L90-178	L88-063	4.6	48	8.6	31	0.53	53	157	73	2.03	41
L90-178	L89-152	4.6	47	10.0	75	0.46	28	148	56	1.93	20
L90-191	LCP85-384	4.9	63	11.3	95	0.43	21	143	47	1.93	20
L91-230	CP76-331	4.1	26	7.5	10	0.55	65	131	27	2.27	89
L91-250	CP91-572	4.3	32	9.7	69	0.44	24	148	56	1.87	10
L91-250	US90-027	3.2	9	8.8	36	0.37	7	128	19	1.83	5
L91-255	CP91-525	5.7	85	10.0	77	0.57	72	161	82	2.10	62
L91-255	US90-018	5.3	75	10.7	89	0.49	41	148	56	1.98	29

Table 6. Continue.

Female	Male	Plant wt.		Stalks per plant		Stalk wt.		Stalk length		Stalk diam.	
		mean	pcnt'l	mean	pcnt'l	mean	pcnt'l	mean	pcnt'l	mean	pcnt'l
		kg		no.		kg		cm		cm	
L91-266	93P3	1.7	1	5.9	1	0.29	2	100	1	1.85	8
L91-276	CP91-572	3.4	11	8.4	26	0.41	13	146	52	1.85	8
L91-276	US90-027	3.9	21	8.1	21	0.49	37	140	42	2.03	44
L91-281	CP91-558	5.4	76	9.3	55	0.60	80	157	73	2.13	67
L91-281	CP91-568	5.1	68	8.9	41	0.58	74	142	45	2.17	77
L91-281	L91-255	6.8	96	8.8	37	0.77	98	162	83	2.40	96
L91-281	93P1	3.9	20	9.1	49	0.43	19	133	31	1.97	27
L91-286	CP76-331	6.3	91	11.1	94	0.56	70	158	78	2.08	56
L91-286	93P3	4.5	44	10.8	91	0.43	18	140	42	1.95	25
L91-288	LCP82-089	4.3	36	9.3	58	0.47	30	131	25	2.07	53
L91-288	L91-255	4.1	29	9.5	64	0.42	17	153	65	1.80	3
L91-288	93P3	4.7	51	9.3	57	0.49	40	139	37	2.03	41
L91-290	CP75-1082	6.5	92	7.8	17	0.86	99	184	98	2.38	95
L91-290	CP89-855	4.0	23	10.5	87	0.38	9	139	40	1.80	3
US77-017	CP62-258	6.1	90	11.6	96	0.52	50	141	43	2.10	62
US77-017	CP76-331	6.8	95	9.7	71	0.69	95	173	95	2.23	85
US77-017	LCP85-336	4.5	42	8.3	24	0.54	60	158	76	2.05	49
US77-017	LCP85-384	4.7	54	7.6	15	0.63	88	185	99	2.05	49
US77-017	L90-191	5.9	88	10.1	79	0.60	80	168	91	2.08	56
US77-017	L91-261	4.7	54	8.7	33	0.54	62	165	89	1.98	29
US77-017	US90-021	5.5	81	9.4	62	0.58	72	170	94	2.03	41
US90-018	LCP85-384	5.1	71	9.5	62	0.55	66	162	85	2.00	34
US90-021	LCP85-384	4.1	27	12.0	97	0.34	5	127	18	1.80	3
US90-026	CP91-525	3.0	6	9.6	66	0.30	2	109	4	1.80	3
US90-026	CP91-568	5.2	72	9.7	71	0.53	57	140	42	2.13	67
US90-026	LCP85-384	5.3	74	10.0	77	0.55	67	162	85	2.03	37
US90-027	CP91-558	4.0	24	7.6	15	0.52	51	149	58	2.03	37

1995 LOUISIANA "L" NURSERY VARIETY TRIALS

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Five years after the initial hybridization of parents, clones that have met or exceeded criteria for important characteristics at previous selection stages are assigned permanent numbers by the Louisiana (L) Sugarcane Variety Development Program. These varieties are planted in replicated single row "nursery" tests.

One objective of the nursery stage is to identify and select varieties that will perform well across the range of environments a commercial variety will probably encounter in Louisiana. Three tests are normally planted during the year of assignment and three additional tests are planted the year after assignment (Table 1).

Nursery trials were planted in single row (six-foot centers), 16 foot long plots using two replications per location in a randomized complete block design. Five commercial check varieties (CP65-357, CP70-321, CP72-370, CP74-383, and LCP82-089) were included in tests for comparison basis.

Stalk counts were made in August. During the normal harvest season, ten-stalk samples were harvested by hand and stripped of leaves. At the St. Gabriel Sucrose Laboratory, each sample was weighed and milled to obtain a juice sample for analysis. Brix was measured by refractometer and sucrose by polarization. Sucrose was estimated by the Winter-Carp formula. Cane yield was estimated as the product of stalk weight and stalk number. Sucrose yield was calculated as the product of sucrose content and cane yield.

Analysis of variance were performed for each assigned series, crop and location-soil texture combination. A combined analysis was performed among location for each crop and assignment series. Minimum significant differences (MSD) were calculated by the Waller-Duncan multiple range tests (SAS, 1985). Results from Nursery variety trials harvested in 1995 are presented in tables 2-20.

References

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Table 1. Planting and harvest dates of nursery tests planted or harvested in 1995.

Series	Location[1]	Soil Texture[2]	Planting Date	Harvest Dates			Varieties[3]	
				1993	1994	1995	No. Planted	No. Harvest
1992	Iberia	B.s.c	10/26/92	12/01	11/04	10/17	67	9
1992	St.G.	S.c.	10/26/92	11/11	11/14	10/12	70	9
1992	Ardoyne	C.s.l.	09/23/93		11/21	11/01	41	9
1992	Lev.-St.J.	D.s.l.	09/23/93		11/17	11/14	37	9
1992	Glenwood	C.s.l.	10/04/93		11/10	10/31	41	9
1993	Iberia	B.s.c.	10/23/93		12/07	11/01	42	12
1993	St.G.	C.s.l.	10/20/93		12/05	11/06	42	12
1993	Ardoyne	C.s.l.	10/19/93		11/21	11/01	42	12
1993	Lev.-St.J.	D.s.l.	08/31/94			11/27	28	12
1993	Stoute	B.s.c.	08/31/94			11/27	28	12
1993	Westfield	S.s.c.	10/06/94			11/29	28	12
1994	Iberia	B.s.c.	10/20/94			12/06	45	26
1994	St.G.	S.c.	10/17/94				45	26
1994	Ardoyne	C.s.l.	10/21/94			11/29	45	26
1995	Stoute	B.s.c.	08/31/95				54	
1995	Westfield	S.s.c.	09/27/95				54	
1995	Peebles	J.s.l.	09/15/95				54	
1995	Iberia	B.s.c.	10/19/95				51	
1995	St.G.	S.c.	10/23/95				51	
1995	Ardoyne	C.s.l.	10/17/95				51	

[1] Iberia-Iberia Research Station, St.G.- St. Gabriel Research Station, Peebles- Peebles Plantation, Westfield- Westfield Plantation, Stoute- D. Stoute Farm, Ardoyne- U.S.D.A. Ardoyne Farm, Lev.-St.J.- Levert-St. John, Glenwood- Glenwood Plantation.

[2] B.s.c.- Baldwin silty clay, S.s.l.- commerce silt loam, J.s.l.- Jeanerette silt loam, S.c.- Sharkey clay, D.s.l.- Dundee silt loam.

[3] Number of varieties per replication including three commercial checks. All tests contained two replications.

Table 2. 1995 second ratoon means of the 1992 "L" series at Iberia Research Station.

Variety	Sucrose yield	Sucrose content	Cane yield	Stalk number	Stalk weight
	lbs/A	lbs/ton	tons/A	no/A	lbs
CP70-321	11406	241	47.3	38116	2.48
CP74-383	7716	196	39.1	32670	2.39
LCP82-089	15292	263	58.2	44922	2.60
LHo92-307	14134	217	65.3	50140	2.61
L92-312	12230	257	47.6	51274	1.86
LHo92-314	11587	229	50.4	49005	2.06
L92-315	11833	240	49.3	44468	2.21
L92-319	7389	209	35.4	34485	2.05
L92-321	8471	231	37.5	30175	2.47
$MSD_{.05}$	3723	35	17.7	9671	0.41

Table 3. 1995 second ratoon means of the 1992 "L" series at the St. Gabriel Research Station on a Sharkey clay.

Variety	Sucrose yield	Sucrose content	Cane yield	Stalk number	Stalk weight
	lbs/A	lbs/ton	tons/A	no/A	lbs
CP70-321	3733	203	18.5	33578	1.10
CP74-383	5039	219	23.0	32217	1.46
LCP82-089	3999	205	19.1	32217	1.18
LHo92-307	6819	234	29.1	35620	1.66
L92-312	6321	245	25.8	42199	1.23
LHo92-314	4046	199	20.2	28133	1.43
L92-315	5330	218	24.6	36754	1.34
L92-319	3509	184	18.8	24503	1.53
L92-321	2989	203	14.5	22007	1.32
$MSD_{.05}$	2606	NS	8.4	12155	0.55

Table 4. 1995 second ratoon means of the 1992 "L" series across location[1].

Variety	Sucrose yield	Sucrose content	Cane yield	Stalk number	Stalk weight
	lbs/A	lbs/ton	tons/A	no/A	lbs
CP70-321	7569	222	32.9	35847	1.79
CP74-383	6377	208	31.0	32443	1.92
LCP82-089	9645	234	38.6	38569	1.89
LHo93-307	10476	225	47.2	42880	2.13
L92-312	9275	251	36.7	46737	1.54
LHo92-314	7816	214	35.3	38569	1.74
L92-315	8582	229	37.0	40611	1.77
L92-319	5449	197	27.1	29494	1.79
L92-321	5730	217	26.0	26091	1.89
$MSD_{.05}$	4834	53	15.2	10267	NS

Table 5. 1995 first ratoon means of the 1992 "L" series at Ardoyne Farm.

Variety	Sucrose yield	Sucrose content	Cane yield	Stalk number	Stalk weight
	lbs/A	lbs/ton	tons/A	no/A	lbs
CP65-357	9215	254	36.1	29267	2.43
CP70-321	13228	267	49.5	36301	2.73
LCP82-089	11777	260	45.3	37208	2.44
LHo92-307	14074	247	56.7	44922	2.51
L92-312	11376	302	37.7	36754	2.08
LHo92-314	11606	264	44.0	42880	2.05
L92-315	13498	264	51.0	48098	2.12
L92-319	12674	245	51.9	37662	2.76
L92-321	15429	278	55.2	37662	2.92
$MSD_{.05}$	NS	17	29.0	22000	0.60

Table 6. 1995 first ratoon means of the 1992 "L" series at Levert-St. John Plantation.

Variety	Sucrose yield	Sucrose content	Cane yield	Stalk number	Stalk weight
	lbs/A	lbs/ton	tons/A	no/A	lbs
CP65-357	9603	292	32.9	28813	2.28
CP70-321	10919	307	35.6	33578	2.13
LCP82-089	10053	291	34.7	32217	2.15
LHo92-307	15083	257	59.0	46510	2.54
L92-312	11664	304	38.4	40838	1.88
LHo92-314	12083	272	44.5	42880	2.12
L92-315	9183	274	33.8	38569	1.75
L92-319	11012	282	39.3	34258	2.29
L92-321	15335	285	53.9	37435	2.88
$MSD_{.05}$	2603	25	11.9	13042	0.59

Table 7. 1995 first ratoon means of the 1992 "L" series at Glenwood Plantation.

Variety	Sucrose yield	Sucrose content	Cane yield	Stalk number	Stalk weight
	lbs/A	lbs/ton	tons/A	no/A	lbs
CP65-357	8252	257	32.1	29948	2.14
CP70-321	11821	275	43.0	36754	2.33
LCP82-089	8513	277	30.8	36527	1.68
LHo92-307	12466	264	47.2	42880	2.20
L92-312	11189	287	39.0	43560	1.79
LHo92-314	9426	239	39.3	39477	2.00
L92-315	9086	244	37.3	46510	1.61
L92-319	11431	239	47.9	42199	2.27
L92-321	7938	279	28.5	28814	2.00
$MSD_{.05}$	4942	16	16.1	11034	0.50

Table 8. 1995 first ratoon means of the 1992 "L" series across location[1].

Variety	Sucrose yield	Sucrose content	Cane yield	Stalk number	Stalk weight
	lbs/A	lbs/ton	tons/A	no/A	lbs
CP65-357	9023	268	33.7	29343	2.28
CP70-321	11989	283	42.7	35544	2.39
LCP82-089	10114	276	36.9	35317	2.09
LHo92-307	13874	256	54.3	44770	2.42
L92-312	11409	298	38.3	40384	1.92
LHo92-314	11038	258	42.6	41745	2.05
L92-315	10589	260	40.7	44392	1.82
L92-319	11705	255	46.4	38040	2.44
L92-321	12901	281	45.8	34637	2.60
$MSD_{.05}$	3148	20	12.6	5773	0.34

[1] Ardoyne Farm, Levert-St. John, Glenwood Plantation.

Table 9. 1995 first ratoon means of the 1993 "L" series at the Iberia Research Station.

Variety	Sucrose yield	Sucrose content	Cane yield	Stalk number	Stalk weight	Fiber
	lbs/A	lbs/ton	tons/A	no/A	lbs	%
CP65-357	13729	272	49.7	34259	2.91	13.9
CP70-321	18252	260	70.4	44468	3.17	12.9
LCP82-089	12206	265	46.1	45602	2.02	12.6
L93-363	14332	245	58.9	53996	2.023	11.1
L93-365	15272	250	60.8	43334	2.80	10.4
L93-376	10421	232	45.1	41518	2.18	11.2
L93-378	13580	223	59.8	55812	2.14	12.1
L93-385	12740	214	59.3	37435	3.17	13.4
L93-391	11360	248	45.5	36074	2.51	12.6
L93-395	12477	248	50.3	41972	2.41	13.5
L93-397	15820	280	56.5	38116	2.97	14.0
L93-399	16318	273	59.9	48325	2.48	14.0
$MSD_{.05}$	8709	NS	17.0	10605	0.57	0.3

Table 10. 1995 first ratoon means of the 1993 "L" series at the St. Gabriel Research Station on a Commerce silt loam.

Variety	Sucrose yield	Sucrose content	Cane yield	Stalk number	Stalk weight	Fiber
	lbs/A	lbs/ton	tons/A	no/A	lbs	%
CP65-357	10967	232	47.4	39703	2.39	13.6
CP70-321	12787	258	49.6	41292	2.42	12.1
LCP82-089	13392	261	51.5	49459	2.10	13.7
L93-363	13542	238	56.9	48098	2.43	11.7
L93-365	12573	248	50.8	38796	2.62	11.8
L93-376	12140	241	50.4	46283	2.20	11.2
L93-378	15037	258	58.4	53089	2.20	12.6
L93-385	12595	251	50.3	36754	2.70	14.0
L93-391	15042	261	57.9	41519	2.77	14.0
L93-395	10945	250	43.9	41972	2.09	13.0
L93-397	8921	263	33.8	29948	2.25	14.0
L93-399	9577	234	40.8	39476	2.07	13.3
$MSD_{.05}$	5830	23	23.7	17826	0.60	.6

Table 11. 1995 first ratoon means of the 1993 "L" series at Ardoyne Farm.

Variety	Sucrose yield	Sucrose content	Cane yield	Stalk number	Stalk weight	Fiber
	lbs/A	lbs/ton	tons/A	no/A	lbs	%
CP65-357	10258	241	43.6	32897	2.52	13.6
CP70-321	14531	251	57.8	42426	2.73	12.0
LCP82-089	13190	272	48.5	41292	2.35	13.3
L93-363	16397	257	63.9	52181	2.46	11.4
L93-365	15095	256	58.9	46737	2.54	10.9
L93-376	14905	261	57.2	45829	2.50	10.9
L93-378	15774	270	58.4	49006	2.39	11.9
L93-385	10045	235	42.6	32444	2.62	13.5
L93-391	11603	271	43.0	33351	2.56	15.1
L93-395	10942	258	42.6	39476	2.16	13.1
L93-397	10887	279	39.4	33124	2.37	13.1
L93-399	11713	268	43.8	41972	2.13	13.2
$MSD_{.05}$	5308	47	20.1	10322	NS	1.4

Table 12. 1995 first ratoon means of the 1993 "L" series across location[1].

Variety	Sucrose yield	Sucrose content	Cane yield	Stalk number	Stalk weight	Fiber
	lbs/A	lbs/ton	tons/A	no/A	lbs	%
CP65-357	11651	248	46.9	35620	2.61	13.7
CP70-321	15190	256	59.2	42728	2.77	12.3
LCP82-089	12929	266	48.7	45451	2.16	13.2
L93-363	14757	247	59.9	51425	2.37	11.4
L93-365	14313	251	56.8	42955	2.65	11.0
L93-376	12488	244	50.9	44543	2.29	11.1
L93-378	14797	250	58.8	52635	2.24	12.2
L93-385	11793	233	50.7	35544	2.83	13.7
L93-391	12668	260	48.8	36981	2.61	13.9
L93-395	11455	252	45.6	41140	2.22	13.2
L93-397	11876	274	43.2	33729	2.53	13.7
L93-399	12536	258	48.2	43258	2.23	13.5
$MSD_{.05}$	5160	31	13.8	5354	0.39	.09

[1] Ardoyne Farm, Iberia, St. Gabriel on a Commerce silt loam.

Table 13. 1995 plant cane means of the 1993 "L" series at Levert-St. John Plantation.

Variety	Sucrose yield	Sucrose content	Cane yield	Stalk number	Stalk weight
	lbs/A	lbs/ton	tons/A	no/A	lbs
CP70-321	7915	290	27.3	25410	2.15
CP72-370	9194	283	32.4	34485	1.88
LCP82-089	10136	303	33.6	34712	1.92
L93-363	9653	288	33.4	31763	2.11
L93-365	11427	290	39.6	33805	2.34
L93-376	10716	284	37.7	39703	1.90
L93-378	8578	300	28.7	29040	1.94
L93-385	11912	283	42.1	29494	2.89
L93-391	6569	292	22.6	19058	2.37
L93-395	9842	301	32.7	30402	2.16
L93-397	7251	316	22.9	20192	2.27
L93-399	7143	306	23.3	25183	1.85
$MSD_{.05}$	5427	13	17.1	14766	0.53

Table 14. 1995 plant cane means of the 1993 "L" series at Stoute Farm.

Variety	Sucrose yield	Sucrose content	Cane yield	Stalk number	Stalk weight
	lbs/A	lbs/ton	tons/A	no/A	lbs
CP70-321	12700	289	43.7	36981	2.31
CP72-370	11859	265	44.8	38115	2.36
LCP82-089	11764	297	39.7	33805	2.35
L93-363	12970	266	48.9	36300	2.70
L93-365	8573	285	29.8	23822	2.48
L93-376	12791	280	45.7	43107	2.12
L93-378	8830	288	30.7	35846	1.71
L93-385	8388	260	32.4	25637	2.53
L93-391	8618	280	30.9	23368	2.69
L93-395	10159	271	37.6	32444	2.32
L93-397	10852	289	37.6	31309	2.41
L93-399	7595	285	26.7	28813	1.86
$MSD_{.05}$	5192	40	14.9	8892	0.84

Table 15. 1995 plant cane means of the 1993 "L" series at Westfield Plantation.

Variety	Sucrose yield	Sucrose content	Cane yield	Stalk number	Stalk weight
	lbs/A	lbs/ton	tons/A	no/A	lbs
CP70-321	5782	251	22.9	18604	2.46
CP72-370	5395	254	21.3	19739	2.17
LCP82-089	6612	255	26.0	21100	2.42
L93-363	5708	238	24.0	19512	2.46
L93-365	6893	234	29.4	22688	2.59
L93-376	5811	229	25.3	24503	2.07
L93-378	6234	269	23.2	25637	1.81
L93-385	4974	247	20.1	18377	2.17
L93-391	5038	259	19.5	14520	2.66
L93-395	6898	239	28.9	24503	2.36
L93-397	5598	274	20.5	19058	2.14
L93-399	5740	257	22.3	21100	2.12
$MSD_{.05}$	NS	38	14.3	6500	0.61

Table 16. 1995 plant cane means of the 1993 "L" series across location[1].

Variety	Sucrose yield	Sucrose content	Cane yield	Stalk number	Stalk weight
	lbs/A	lbs/ton	tons/A	no/A	lbs
CP70-321	8799	277	31.3	26998	2.30
CP72-370	8816	267	32.8	30780	2.13
LCP82-089	9504	285	33.1	29872	2.23
L93-363	9444	264	35.4	29191	2.42
L93-365	8964	270	32.9	26771	2.47
L93-376	9773	265	36.2	35771	2.03
L93-378	7880	286	27.5	30174	1.82
L93-385	8424	263	31.5	24503	2.53
L93-391	6742	277	24.3	18982	2.57
L93-395	8966	270	33.0	29116	2.28
L93-397	7900	293	27.0	23520	2.27
L93-399	6826	283	24.1	25032	1.94
$MSD_{.05}$	3679	15	12.2	7139	0.34

[1] Levert-St. John, Stoute, Westfield Plantation.

Table 17. 1995 plant cane means of the 1994 "L" series at the Iberia Research Station.

Variety	Sucrose yield	Sucrose content	Cane yield	Stalk number	Stalk weight
	lbs/A	lbs/ton	tons/A	no/A	lbs
CP70-321	6878	260	26.6	20646	2.55
CP72-370	7392	274	26.9	22461	2.39
LCP82-089	8775	279	31.5	24276	2.61
L94-405	7475	268	28.0	26998	2.08
L94-407	9461	271	35.0	26999	2.57
L94-411	8160	255	32.1	25637	2.50
L94-412	6225	279	22.3	28813	1.55
L94-418	6135	288	21.3	26771	1.59
L94-420	3041	174	18.3	16109	2.29
L94-421	6432	286	22.8	18151	2.49
L94-422	7779	278	28.3	30402	1.84
L94-424	12472	283	44.1	28814	3.07
L94-425	6598	267	24.8	27906	1.78
L94-426	7235	265	27.3	21553	2.53
L94-427	5367	297	18.1	19965	1.82
L94-428	7955	296	27.1	20873	2.56
L94-430	6909	297	23.2	26771	1.73
L94-431	9538	268	35.7	25184	2.83
L94-432	10321	276	37.4	31309	2.40
L94-433	10038	272	36.9	31990	2.32
L94-436	8115	260	31.3	22007	2.87
L94-438	11423	285	40.0	28813	2.80
L94-440	7475	267	28.0	26999	2.08
L94-441	5955	279	21.3	17243	2.42
L94-442	5538	285	19.4	19058	2.06
L94-446	8961	275	32.7	27452	2.39
$MSD_{.05}$	2385	97	6.9	6499	0.46

Table 18. 1995 plant cane means of the 1994 "L" series at the St. Gabriel Research Station on a Sharkey clay.

Variety	Sucrose yield	Sucrose content	Cane yield	Stalk number	Stalk weight
	lbs/A	lbs/ton	tons/A	no/A	lbs
CP70-321	12217	276	44.3	29948	2.96
CP72-370	10249	280	36.5	29267	2.48
LCP82-089	12548	286	43.7	32670	2.67
L94-405	11391	282	40.3	34259	2.36
L94-407	16162	283	57.0	40611	2.78
L94-411	9577	265	36.1	33124	2.18
L94-412	11117	300	37.2	36527	2.04
L94-418	9457	302	31.3	33124	1.88
L94-420	10659	293	36.4	31536	2.34
L94-421	10587	297	35.6	28360	2.55
L94-422	10683	286	37.4	34032	2.21
L94-424	13153	291	45.3	26318	3.44
L94-425	10907	283	38.5	38342	2.03
L94-426	11184	282	39.9	29721	2.68
L94-427	11188	290	38.7	31763	2.43
L94-428	14168	283	50.1	37208	2.73
L94-430	11270	310	36.5	33805	2.17
L94-431	18128	284	63.9	38796	3.32
L94-432	11912	281	42.4	33124	2.56
L94-433	12324	282	43.5	38569	2.26
L94-436	9982	283	35.4	27452	2.56
L94-438	13153	285	46.2	29948	3.11
L94-440	11284	276	40.8	26772	3.03
L94-441	10326	277	37.3	32444	2.34
L94-442	9856	303	32.6	26999	2.41
L94-446	11799	261	45.1	28587	3.15
$MSD_{.05}$	5661	33	17.7	13523	0.51

Table 19. 1995 plant cane means of the 1994 "L" series at Ardoyne Farm.

Variety	Sucrose yield	Sucrose content	Cane yield	Stalk number	Stalk weight
	lbs/A	lbs/ton	tons/A	no/A	lbs
CP70-321	13634	290	47.1	31990	2.97
CP72-370	13636	289	47.0	33351	2.83
LCP82-089	12387	299	41.6	31536	2.59
L94-405	15058	304	49.5	39023	2.53
L94-407	17207	292	59.0	35847	3.30
L94-411	15370	295	52.2	36754	2.85
L94-412	12104	307	39.2	36981	2.10
L94-418	11278	303	37.2	33351	2.24
L94-420	12579	304	41.4	27452	3.02
L94-421	12445	300	41.5	31309	2.65
L94-422	12868	289	44.8	35620	2.51
L94-424	18815	280	67.2	33351	4.03
L94-425	12947	308	41.8	36527	2.25
L94-426	13012	297	43.8	29267	2.98
L94-427	12573	292	43.2	26545	3.25
L94-428	15501	302	51.5	34712	2.96
L94-430	14618	232	45.5	37208	2.42
L94-431	14527	270	53.6	29041	3.67
L94-432	11817	299	39.4	29948	2.64
L94-433	11093	300	37.0	32671	2.27
L94-436	10741	281	38.3	22688	3.40
L94-438	13749	303	45.5	27225	3.37
L94-440	13232	298	44.6	30628	2.93
L94-441	10248	297	34.6	27679	2.50
L94-442	14552	297	49.1	38569	2.55
L94-446	10263	291	35.3	25410	2.79
$MSD_{.05}$	8609	23	26.5	16086	0.49

Table 20. 1995 plant cane means of the 1994 "L" series across location[1].

Variety	Sucrose yield	Sucrose content	Cane yield	Stalk number	Stalk weight
	lbs/A	lbs/ton	tons/A	no/A	lbs
CP70-321	10909	275	39.3	27528	2.82
CP72-370	10425	281	36.8	28360	2.57
LCP82-089	11237	288	38.9	29494	2.62
L94-405	11308	285	39.2	33426	2.32
L94-407	14277	282	50.3	34485	2.88
L94-411	11036	271	40.1	31838	2.51
L94-412	9815	295	32.9	34107	1.90
L94-418	8957	298	29.9	31082	1.90
L94-420	8760	257	32.0	25032	2.55
L94-421	9821	294	33.3	25940	2.56
L94-422	10443	284	36.8	33351	2.19
L94-424	14813	285	52.2	29494	3.51
L94-425	10151	286	35.0	34258	2.02
L94-426	10477	281	37.0	26847	2.73
L94-427	9709	293	33.3	26091	2.50
L94-428	12541	293	42.9	30931	2.75
L94-430	10932	310	35.0	32594	2.11
L94-431	14064	274	51.1	31007	3.27
L94-432	11350	286	39.7	31460	2.53
L94-433	11152	285	39.1	34410	2.28
L94-436	9612	274	35.0	24049	2.94
L94-438	12775	291	43.9	28662	3.09
L94-440	10664	280	37.8	28133	2.68
L94-441	8843	284	31.0	25788	2.42
L94-442	9982	295	33.7	28208	2.34
L94-446	10341	276	37.7	27150	2.77
$MSD_{.05}$	2654	37	8.7	6879	0.32

[1] Ardoyne Farm, Iberia, St. Gabriel on Sharkey clay.

1995 INFIELD VARIETY TRIALS

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The infield variety trials of the Louisiana (L) Sugarcane Variety Development Programs have traditionally been planted from the year after number assignment through the year of introduction to outfield test locations for a seed increase. These trials are the first machine harvested tests in the program. The purpose of the trials is to estimate yields on a larger plot basis than used by earlier stages in the selection program and to initiate screening of experimental clones for suitability to mechanical harvest.

The 1995 sugarcane crop at St. Gabriel looked promising early in the year because of the mild temperatures during the 1994-95 winter and an adequate amount of rainfall during the growing season. The harvest conditions were exceptional and the cane quality was good because of the below normal rainfall during the fall months.

Normal recommended cultural practices were used at St. Gabriel in 1995. Sinbar (½ lb./A terbacil) and Atrazine (2 qt./A) was applied to tests on Sharkey clay and Sencor 4L (2 qt./A;41% AI) and Atrazine (2 qt./A) was applied to tests on Commerce silt loam after planting in the fall. In early February, 2-4,D (1 qt./A;46.88% AI) and Atrazine (2 qt./A) was applied to all plant-cane and ratoon trials. During the third week of April, Sencor 4L (2 qt.;41% AI) and 2-4,D (1 qt./A; 46.88% AI) was applied after off-barring. Asulox (4.0 pts./A) was applied once in late April and again, where needed, in May. Fields were fertilized with (120 lbs. N; 32% liquid N) in April. Sugarcane borer (Diatrea saccharalis *F*) populations were monitored on a weekly basis during the months of June, July, and August. Borer infestations in the cane on lighter soils reached economic thresholds during July and August and were treated with two helicopter applications. The first application was Guthion at a rate of (0.75 lbs./A) on July 9,1995. The second application was Baythroid at a rate of (0.033 lbs./A) on August 19,1995.

At Ardoyne Farm, normal cultural practices were used in 1995. In early April, Karmex (1 lb./acre) and Weedmaster (1 qt./acre) were applied. During the last week of April, tests were fertilized at a rate of 100 lbs. N, 34 lbs. P, and 67 lbs. K. During the first week of June, Atrazine (1.5 qt./acre) plus Prowl 3.3 EC (2 qt./acre) were applied at layby.

The infield variety trials were planted in Sharkey clay (very fine, montmorillonitic, nonacid, thermic, typic hydralquent) and Commerce silt loam (fine-silty, mixed, nonacid, thermic, aeric fluvaquent) soils on the St. Gabriel Research Station and in a Commerce silt loam at the USDA-ARS Ardoyne Farm near Chacahoula, LA. For each assignment series, infield

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tests have traditionally been planted for three years. In the past, the LAES and USDA would plant their experimental varieties on their farms in the first year of the test and would also exchange the same varieties to plant seedcane plots at the other agency's farm. This practice was curtailed in 1993 because leaf scald was found at Chacahoula in 1992. The practice was resumed in 1995 after leaf scald was found at St. Gabriel in the fall of 1994. The absence of seed cane of new CP varieties at St. Gabriel affected the number of tests planted at that location.

The 1994 L & 1993 CP series were planted in one trial on August 31, 1995 (Table 1). Randomized complete block design with plots 16 feet long by three rows wide on six foot centers were used in trial. Three commercial check varieties, CP72-370, CP70-321, and LCP82-089 were included in the tests.

From October 18 through November 16,1995 (Table 1), plots were mechanically cut and weighed with a tractor mounted hydraulic weigh rig. No adjustments were made for leaf trash weight. Ten-stalk samples, stripped of leaves, were used to estimate stalk weight and obtain a juice sample for analysis.

Brix was measured by refractometer and sucrose by polarization. Theoretical recoverable sugar (reported as sucrose content) was calculated by the Winter Carp formula as reported by Gravois and Milligan (1992) assuming 12.5% fiber. Sucrose yield was estimated as the product of cane yield and sucrose content.

Analysis of a variance was performed for each crop and assignment series over and by soil type when appropriate. Minimum significant differences (MSD) were calculated by the Waller-Duncan multiple range test (SAS, 1985).

Results are presented in tables 2 through 14.

References:

Gravois, K.A. and S.B. Milligan. 1992. Genetic relationships between fiber and sugarcane yield components. Crop Sci. 32: 62-66

SAS Institute Inc. SAS User's Guide: Statistics, Ver. 5 ed. Cary, NC: SAS Institute Inc., 1985 956pp.

Table 1. Planting and harvest dates of infield tests[1].

Assignment Series	Reps	Soil[2] Texture	Planting Dates	Harvest Dates 1995	1994	1993	Varieties[3] No. Planted	No. Harvest
1990 HoCP	2	C.s.l.*	09/15/92	10/23	11/07	11/18	42	5
1990 HoCP	2	S.c.	09/09/92	10/18	10/31	11/16	41	5
1990 HoCP	2	C.s.l.	09/08/92	10/18	10/31	11/22	41	5
1990 HoCP	2	C.s.l.*	09/02/93	10/30	11/23		13	6
1991 HoCP	2	C.s.l.*	10/01/92	10/25	11/16	11/29	42	7
1991 HoCP	2	C.s.l.*	09/03/93	10/31	12/01		34	7
1991 HoCP	2	C.s.l.*	09/09/94	11/29			13	7
1992 HoCP	2	C.s.l.*	09/14/93	11/08	12/05		40	13
1992 HoCP	2	C.s.l.*	09/06/94	12/07			23	13
1992 L	2	S.c.	09/07/93	10/25	11/16		35	9
1993 L	2	S.c.	08/30/94	11/16			31	12
1993 HoCP	2	C.s.l.*	09/08/94	11/27			46	18
1993 HoCP	2	C.s.l.*	08/31/95				28	
1994 L	2	S.c.	08/31/95				54	

[1] Tests conducted at the St.Gabriel Research Station and the U. S. D. A. Ardoyne Farm.
[2] C.s.l.- Commerce silt loam, S.c.- Sharkey clay, C.s.l.- *-Ardoyne Farm Commerce silt loam.
[3] Number of varieties per replications including 3 commercial checks.

Table 2. 1995 second ratoon means of the 1990 "CP" series at Ardoyne Farm.

Variety	Sucrose yield	Cane yield	Sucrose content	Stalk weight	Stalk number	Fiber
	lbs/A	tons/A	lbs/ton	lbs	no/A	
CP65-357	8784	39.8	221	2.21	36071	12.5
CP70-321	9842	39.6	248	2.18	36361	
CP72-370	9168	37.2	246	2.15	34515	
CP74-383	6805	32.6	208	2.08	31470	
LCP82-089	8578	34.8	245	2.26	30814	
HoCP90-923	9564	38.7	247	1.66	46829	12.2
HoCP90-941	8595	36.7	235	2.43	30196	12.4
$MSD_{.05}$	2217	7.1	26	0.43	6722	NS

Table 3. 1995 second ratoon means of the 1990 "CP" series at the St. Gabriel Research Station on a Sharkey clay.

Variety	Sucrose yield	Cane yield	Sucrose content	Stalk weight	Stalk number
	lbs/A	tons/A	lbs/ton	lbs	no/A
CP70-321	3857	18.6	210	1.55	23740
CP74-383	4293	21.0	204	1.80	23508
LCP82-089	5135	23.1	225	1.70	26776
HoCP90-923	7071	30.1	235	1.50	40134
HoCP90-941	4519	22.4	204	1.55	28509
$MSD_{.05}$	NS	NS	37	NS	NS

Table 4. 1995 second ratoon means of the 1991 "CP" series at the St. Gabriel Research Station on a Commerce silt loam.

Variety	Sucrose yield	Cane yield	Sucrose content	Stalk weight	Stalk number
	lbs/A	tons/A	lbs/ton	lbs	no/A
CP70-321	8338	33.0	254	2.40	27787
CP74-383	6963	32.7	213	2.25	29093
LCP82-089	7369	33.2	222	2.2	30151
HoCP90-923	9040	38.5	237	1.7	45966
HoCP90-941	7123	33.0	216	2.7	24444
$MSD_{.05}$	NS	NS	46	0.5	23580

Table 5. 1995 second ratoon means of the 1990 "CP" series across locations[1].

Variety	Sucrose yield	Cane yield	Sucrose content	Stalk weight	Stalk number
	lbs/A	tons/A	lbs/ton	lbs	no/A
CP70-321	7345	30.4	237	2.04	29296
CP72-370	9168	37.2	246	2.15	34515
CP74-383	6020	28.8	209	2.04	28023
LCP82-089	7027	30.3	231	2.05	29247
HoCP90-923	8558	35.8	240	1.62	44309
HoCP90-941	6745	30.7	218	2.23	27716
$MSD_{.05}$	1856	5.9	26	0.49	5831

[1]Ardoyne Farm and St. Gabriel Sharkey clay and Commerce silt loam.

Table 6. 1995 first ratoon means of the 1990 "CP" series at Ardoyne Farm.

Variety	Sucrose yield	Cane yield	Sucrose content	Stalk weight	Stalk number	Fiber
	lbs/A	tons/A	lbs/ton	lbs	no/A	
CP65-357	7872	35.2	224	2.53	27785	12.4
CP70-321	9484	37.3	255	2.61	28630	
CP74-383	6731	31.7	213	2.61	24457	
LCP82-089	7887	32.1	246	2.57	24968	
HoCP90-923	9681	37.8	256	1.85	40851	11.7
HoCP90-941	8828	38.8	228	3.03	25639	12.3
$MSD_{.05}$	1194	5.9	24	0.46	6841	NS

Table 7. 1995 second ratoon means of the 1991 "CP" series at Ardoyne Farm.

Variety	Sucrose yield	Cane yield	Sucrose content	Stalk weight	Stalk number	Fiber
	lbs/A	tons/A	lbs/ton	lbs	no/A	
CP65-357	8095	36.0	227	2.54	28201	12.7
CP70-321	9858	40.6	243	2.13	38146	
CP74-383	6294	30.6	206	2.35	25995	
LCP82-089	9110	37.2	245	2.15	34637	
HoCP91-527	10448	38.9	269	2.09	37221	13.7
HoCP91-552	8954	36.4	246	1.73	42098	16.0
HoCP91-555	11434	41.0	279	1.96	41968	14.2
$MSD_{.05}$	2273	10.4	28	0.39	5391	1.5

Table 8. 1995 first ratoon means of the 1991 "CP" series at Ardoyne Farm.

Variety	Sucrose yield	Cane yield	Sucrose content	Stalk weight	Stalk number	Fiber
	lbs/A	tons/A	lbs/ton	lbs	no/A	
CP65-357	8512	35.3	242	2.55	27801	13.3
CP70-321	9446	37.6	252	2.56	29482	
CP74-383	6628	31.5	210	2.38	27188	
LCP82-089	9094	36.1	252	2.21	33069	
HoCP91-527	9418	36.6	258	2.18	33650	14.8
HoCP91-552	9474	37.4	254	2.02	37077	14.9
HoCP91-555	10648	38.6	276	1.97	39294	13.4
$MSD_{.05}$	2038	NS	18	0.55	15688	NS

Table 9. 1995 plant cane means of the 1991 "CP" series at Ardoyne Farm.

Variety	Sucrose yield	Cane yield	Sucrose content	Stalk weight	Stalk number	Fiber
	lbs/A	tons/A	lbs/ton	lbs	no/A	
CP65-357	8405	29.4	286	2.48	23729	13.0
CP70-321	8507	30.4	280	2.61	23365	
CP72-370	7240	26.5	273	2.28	23348	
LCP82-089	8876	33.0	269	1.99	33166	
HoCP91-527	7911	26.1	304	2.27	23099	13.3
HoCP91-552	8531	30.6	278	2.04	30544	14.5
HoCP91-555	9636	31.0	311	1.99	31429	13.4
$MSD_{.05}$	1974	6.4	23	0.56	11294	NS

Table 10. 1995 first ratoon means of the 1992 "CP" series at Ardoyne Farm.

Variety	Sucrose yield	Cane yield	Sucrose content	Stalk weight	Stalk number	Fiber
	lbs/A	tons/A	lbs/ton	lbs	no/A	
CP65-357	8453	32.2	263	2.46	26186	13.0
CP70-321	10060	36.9	273	2.31	31954	
CP74-383	7819	32.7	239	2.48	26387	
LCP82-089	8977	33.1	271	2.22	29905	
HoCP92-618	8344	30.4	277	2.26	26932	14.0
HoCP92-624	10884	40.4	270	2.28	36164	13.7
HoCP92-645	8831	34.0	260	1.66	41130	13.8
HoCP92-648	8517	31.5	271	2.18	28830	11.9
HoCP92-654	6938	28.1	246	2.23	25709	12.0
HoCP92-663	6697	24.8	273	1.98	25422	12.4
HoCP92-664	9833	35.0	281	1.92	36390	15.1
HoCP92-674	10230	36.5	281	2.24	32644	13.0
HoCP92-678	8850	32.5	273	1.93	33675	16.3
$MSD_{.05}$	2411	9.7	47	0.47	14680	1.1

Table 11. 1995 plant cane means of the 1992 "CP" series at Ardoyne Farm.

Variety	Sucrose yield	Cane yield	Sucrose content	Stalk weight	Stalk number	Fiber
	lbs/A	tons/A	lbs/ton	lbs	no/A	
CP65-357	10494	34.8	302	2.80	24814	11.9
CP70-321	10988	36.5	301	2.39	30588	
CP72-370	10766	37.5	287	2.53	29776	
LCP82-089	7893	28.3	279	2.56	22055	
HoCP92-618	10104	33.8	300	2.49	27061	14.1
HoCP92-624	11542	38.4	301	2.62	29538	13.2
HoCP92-645	8444	30.2	279	1.74	34790	12.6
HoPC92-648	10984	35.7	307	2.24	32514	11.4
HoCP92-654	9957	34.3	291	2.10	34186	13.3
HoCP92-663	7404	25.5	292	2.31	22410	11.4
HoCP92-664	10306	35.0	295	2.07	33887	14.1
HoCP92-674	10804	35.6	304	2.60	27340	12.7
HoCP92-678	9095	32.3	281	2.35	27492	14.0
$MSD_{.05}$	3038	11.1	19	.5	16051	2.0

Table 12. 1995 first ratoon means of the 1992 "L" series at St. Gabriel Research Station on a Sharkey clay.

Variety	Sucrose yield	Cane yield	Sucrose content	Stalk weight	Stalk number
	lbs/A	tons/A	lbs/ton	lbs	no/A
CP65-357	7064	33.9	208	2.45	27438
CP70-321	9088	36.1	252	2.45	29487
LCP82-089	9558	39.5	242	2.30	34348
LHo92-307	7257	31.7	229	1.95	32434
L92-312	7912	31.7	250	2.00	31700
LHo92-314	7852	34.9	226	2.35	29609
L92-315	8692	36.5	241	1.90	38421
L92-319	6778	27.4	244	2.45	22482
L92-321	8113	31.3	259	2.35	26589
$MSD_{.05}$	2965	12.5	30	0.28	13918

Table 13. 1995 plant cane means of the 1993 "L" series at the St. Gabriel Research Station on a Sharkey clay.

Variety	Sucrose yield	Cane yield	Sucrose content	Stalk weight	Stalk number
	lbs/A	tons/A	lbs/ton	lbs	no/A
CP70-321	10214	37.9	270	2.50	30348
CP72-370	10675	42.2	252	2.80	30572
LCP82-089	10469	39.2	267	2.60	30410
L93-363	10266	37.5	274	2.60	28994
L93-365	8793	32.9	267	2.75	23867
L93-376	9294	33.6	277	2.45	27475
L93-378	11223	40.4	278	2.40	33667
L93-385	11993	47.9	250	2.90	33045
L93-391	8802	30.5	289	2.85	21367
L93-395	8502	34.1	250	2.40	28375
L93-397	9924	34.7	285	2.60	27000
L93-399	12433	45.5	274	2.45	37144
$MSD_{.05}$	3039	7.9	24	0.69	10098

Table 14. 1995 plant cane means of the 1993 "CP" series at Ardoyne Farm.

Variety	Sucrose yield	Cane yield	Sucrose content	Stalk weight	Stalk number	Fiber
	lbs/A	tons/A	lbs/ton	lbs	no/A	
CP65-357	8431	28.9	292	2.53	22894	12.6
CP70-321	7837	28.6	274	2.57	22260	
CP72-370	7626	28.4	269	2.55	22281	
LCP82-089	7583	28.6	264	2.04	29328	
HoCP93-708	6810	26.1	261	2.63	19845	13.8
HoCP93-727	8032	29.3	274	2.02	29250	14.4
HoCP93-729	8825	30.7	288	2.55	24066	12.8
HoCP93-741	8650	29.3	295	2.24	26168	13.3
HoCP93-742	5491	18.4	297	1.99	18416	16.2
HoCP93-744	8962	30.5	295	2.58	23632	12.3
HoCP93-746	10460	36.9	283	2.99	24670	11.8
HoCP93-749	10901	38.5	284	2.76	27935	11.6
HoCP93-750	10299	34.1	302	2.53	27009	11.7
HoCP93-752	7146	25.8	278	2.72	18971	13.2
HoCP93-754	8667	29.7	292	2.46	24241	12.1
HoCP93-767	9134	32.8	278	2.01	32942	12.2
Ho93-769	7716	28.1	275	1.86	30284	13.3
HoCP93-775	6494	26.2	247	2.47	21168	14.2
$MSD_{.05}$	2095	6.8	27	0.35	9577	1.4

1995 OUTFIELD VARIETY TRIALS[1]

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The outfield variety trials compose the final stage of testing experimental varieties for their potential commercial production in Louisiana. Results of these trials are used in both variety advancement and crossing decisions. These trials are cooperatively conducted at 10 commercial locations throughout the Louisiana sugarcane belt by the Louisiana Agricultural Experiment Station, the United States Department of Agriculture - Agricultural Research Service, and the American Sugar Cane League.

To be considered for release, an experimental variety must equal or exceed the performance of commercial varieties with regard to yield and harvestability across locations, crops, and years. Accurate varietal evaluation requires overall yield performance information in addition to close scrutiny of performance under adverse harvest conditions. The objective of this report is to provide overall and specific location yield data by crop for 1995 outfield tests. Also included are two- and three-year yield analyses for appropriate test varieties.

A randomized complete block design with three replications was used at each location. Plots were three rows wide (six foot centers) and 32 feet long with a five foot alley between plot ends. All trials were harvested mechanically, separated by hand, and weighed with a tractor-mounted hydraulic weigh rig. An 15-stalk sample, not stripped of leaves, was taken from each plot and sent to the USDA sucrose lab. The samples were weighed, milled, and the juice analyzed for Brix and pol. Theoretical recoverable sucrose per ton of cane is reported.

Cane yield for each plot was estimated by plot weight, less 14% to adjust for leaf-trash weight and 10% for harvest efficiency. Stalk number was calculated by dividing adjusted cane yield by stalk weight. Adjustments made to cane yield resulted in lower estimated stalk numbers than those commonly achieved by growers.

Interpreting one year of yield data can be misleading since varieties may differ in relative performance from year to year. Across location means can likewise be misleading since a

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[1]The data for this report were obtained through a cooperative effort of personnel from the Louisiana Agricultural Experiment Station - LSUAC, USDA - Agricultural Research Service, Sugarcane Research Unit, and the American Sugar Cane League in accordance to the provisions of the "Three-way Agreement of 1978." The testing program would not be possible without the full cooperation of the growers at each outfield location.

This project was partially funded by the American Sugar Cane League.

variety, experimental or commercial, may not consistently perform at all locations, and this inconsistency may not be clearly indicated in the overall mean. Multi-year and -location testing attempts to solve these problems by averaging out the inconsistent performances.

A simple statistic has been included to aid in interpreting a variety's performance relative to other varieties in the test. This statistic is the percentage of the test locations a variety was not significantly (NS) different from the best yielding variety at a specific location. Although the best yielding variety at a location may vary, the "percent best" statistic indicates the percent of the tests a variety was in the best yield group. A variety with an 80% NS from best value was in the highest yielding group in 80% of the tests. This statistic intrinsically places more value on more precise tests and helps the reader avoid making incorrect interpretations of the results due to minor differences in mean values. The statistic also provides a better understanding of varietal yield stability across locations than does the overall mean. An additional attribute of this statistic is that the reader may compare varieties of known consistency of performance such as commercial varieties with newly released or experimental varieties.

Analysis of variance was performed for each crop and location combination. A combined analysis was performed over locations within each crop. Minimum significant differences (MSD) were calculated by the Waller-Duncan multiple range test (SAS, 1985).

Sixteen experimental varieties were introduced to the outfield locations for seed increase in 1995 (Table 1). Twelve experimental and seven commercial varieties were planted at ten outfield locations. Eight plant-cane, nine first ratoon, and eight second ratoon tests were harvested in 1995 (Table 2).

Varietal yields are reported by crops and trait with overall means and individual location data in the same table (Tables 3-17). Combined analysis among 1993 through 1995 plant-cane crops (Table 18), first ratoon crops (Table 19), second ratoon crops (Table 20), and 1994 through 1995 first ratoon crops (Table 21) are included to aid in the evaluation of the newest commercial variety, LCP86-454, and the most advanced experimental variety, HoCP88-739.

The harvestability of a sugarcane variety in Louisiana is affected by the erectness and the brittleness of the variety in interaction with the conditions under which it was grown and harvested (weather, row profile, type and condition of the harvester, and skill of the harvester operator). The harvestability of experimental varieties can be observed under a wide range of conditions in the outfield stage of the variety testing program and is an important function of the tests.

Harvestability is subjectively evaluated by documenting the condition of the test field at the time of harvest. As the test field is cut, the outfield agronomists note the erectness of each variety for which yield data will be taken. The heap row is then subjectively rated for scrappiness or the amount of cane left in the plot (Table 22).

References:

SAS Institute, Inc. 1985. SAS User's Guide:Basics, version 5 ed. SAS Institute, Cary, H.C.

Table 1. Varieties planted in the outfield in 1995.

Commercial Varieties†	Experimental Varieties		Varieties Introduced to the Outfield	
CP65-357	HoCP90-923	L92-312	HoCP92-618	L93-365
CP70-321	HoCP90-941	LHo92-314	HoCP92-624	L93-376
CP72-370	HoCP91-527	L92-315	HoCP92-648	L93-378
LCP82-089	HoCP91-552	L92-319	HoCP92-654	L93-385
LHo83-153	HoCP91-555	L92-321	HoCP92-663	L93-391
LCP85-384	LHo92-307	HoCP92-674	HoCP92-664	L93-395
HoCP85-845			HoCP92-678	L93-397
			L93-363	L93-399

† Heat treated seed plots of all nine commercial varieties, including CP79-318 and LCP86-454, were established in 1995 for planting in the replicated plots in 1996.

Table 2. Plant-cane, first ratoon, and second ratoon harvest and planting dates for all outfield locations harvested in 1995.

Location		Plant-cane		First ratoon		Second ratoon	
	1995 Plant Date	1995 Harvest Date	1994 Plant Date	1995 Harvest Date	1993 Plant Date	1995 Harvest Date	1992 Plant Date
Allain	09/14	11/30	09/30	11/15	10/05	10/20	10/07
Bon Secour	09/20	11/28	09/13	11/01	09/30	10/16	10/08
Georgia				11/06	08/25	11/06	10/15
Glenwood	09/19	11/29	09/28	11/07	09/17	10/26	10/12
Lanaux	09/22	12/08	09/22	11/01	09/02	10/17	10/13
Levert-St. John	09/15	12/01	09/20	11/13	09/08	10/18	10/01
Magnolia	09/01	11/27	09/27	11/02	10/07	10/17	10/20
Oaklawn	09/06			10/25	08/27	†	10/02
Palo Alto	09/08			†	09/29	†	10/01
Raceland	09/12	12/07	10/04				
R. Hebert	09/13	11/30	09/26	11/14	09/17	10/19	10/13

† Test lost due to scheduling problems.

Table 3. Plant-cane sucrose yields for six commercial and four experimental varieties at eight outfield locations in 1995.

Variety	Heavy textured soil locations		Light textured soil locations						Mean	NS from best‡
	All.†	Mag.	B.S.	Gln.	Lan.	Race.	R.H.	StJ.		
	lbs sugar acre^{-1}									%
CP65-357	7094	8211	6607	3541	5497	7541	5732	5740	6245	50
CP70-321	5603	8034	6726	5348	7062	6618	5754	5034	6272	25
CP72-370	6707	8178	7814	4848	6048	7876	6243	----	6816	57
LHo83-153	6127	8195	7287	5397	6392	7310	6338	5696	6593	50
LCP85-384	7445	----	7792	7689	7424	9053	8070	6824	7760	100
HoCP85-845	7034	7878	7002	----	8044	8605	6962	4603	7161	86
HoCP88-739	6657	9003	7779	5722	6958	8960	6649	----	7390	71
HoCP90-923	5745	7738	6005	4954	6716	9203	6578	5764	6474	38
HoCP90-941	5479	8140	6089	4445	7358	8561	6419	4415	6363	38
HoCP91-552	6094	8640	5404	4663	5883	8526	5765	4866	6230	38
Mean	6398	8209	6851	5082	6738	8192	6451	5368	6716	50
$MSD_{0.05}$§	1583	ns	1392	964	830	2151	1494	732	631	

† All.-A.V. Allain & Sons, Mag.-Magnolia, B.S.-Bon Secour, Gln.-Glenwood, Lan.-Lanaux, Race.-Raceland Sugars, R.H.-Ronald Hebert, StJ.-Levert-St. John.

‡ Percentage of locations where the variety was not significantly less than the highest yielding variety at that location.

§ $MSD_{0.05}$ - minimum significant difference at the $P \leq 0.05$ level.

ns - no significant difference.

Table 4. Plant-cane cane yield for six commercial and four experimental varieties at eight outfield locations in 1995.

Variety	Heavy textured soil locations		Light textured soil locations						Mean	NS from best‡
	All.†	Mag.	B.S.	Gln.	Lan.	Race.	R.H.	StJ.		
	tons cane acre^{-1}									%
CP65-357	28.0	34.5	23.4	14.3	24.1	29.5	23.1	23.8	25.1	25
CP70-321	21.7	35.7	25.3	21.6	25.9	30.2	22.3	20.4	25.4	25
CP72-370	26.3	35.1	29.5	19.6	25.0	29.4	25.5	----	27.2	43
LHo83-153	24.2	34.3	27.1	23.1	27.9	33.7	24.7	26.0	27.6	63
LCP85-384	27.2	----	27.6	28.0	28.5	35.3	31.3	27.1	29.3	86
HoCP85-845	28.8	37.6	28.4	----	33.1	36.0	30.8	21.3	30.9	86
HoCP88-739	23.6	34.7	27.1	21.7	25.3	33.1	24.6	----	27.2	43
HoCP90-923	22.1	32.0	23.7	19.6	27.7	36.0	27.3	24.3	26.2	25
HoCP90-941	20.9	32.4	24.6	18.6	28.2	30.9	25.8	18.8	25.0	13
HoCP91-552	24.4	35.1	23.1	19.6	26.3	32.9	24.2	22.5	26.0	38
Mean	24.7	34.3	26.0	20.4	27.2	32.6	26.0	23.0	27.0	50
$MSD_{0.05}$§	5.1	4.7	5.2	3.8	2.8	4.5	3.6	3.0	2.1	

† All.-A.V. Allain & Sons, Mag.-Magnolia, B.S.-Bon Secour, Gln.-Glenwood, Lan.-Lanaux, Race.-Raceland Sugars, R.H.-Ronald Hebert, StJ.-Levert-St. John.

‡ Percentage of locations where the variety was not significantly less than the highest yielding variety at that location.

§ $MSD_{0.05}$ - minimum significant difference at the $P \leq 0.05$ level.

Table 5. Plant-cane sucrose content for six commercial and four experimental varieties at eight outfield locations in 1995.

Variety	Heavy textured soil locations		Light textured soil locations						Mean	NS from best‡
	All.†	Mag.	B.S.	Gln.	Lan.	Race.	R.H.	StJ.		
	sugar ton^{-1} cane									%
CP65-357	253	238	281	248	227	256	248	241	249	63
CP70-321	258	225	266	248	273	220	259	248	250	38
CP72-370	255	233	265	247	242	268	245	---	251	43
LHo83-153	254	239	270	234	229	217	257	219	240	25
LCP85-384	274	---	283	275	260	256	258	252	265	100
HoCP85-845	244	210	247	---	243	239	225	216	232	14
HoCP88-739	282	261	287	264	275	270	270	---	273	100
HoCP90-923	259	241	253	252	242	256	241	237	247	38
HoCP90-941	262	251	248	239	262	277	250	234	253	50
HoCP91-552	250	246	232	236	223	259	238	216	238	25
Mean	259	240	263	248	248	252	249	233	249	38
$MSD_{0.05}$§	12	32	16	14	20	45	28	17	12	

† All.-A.V. Allain & Sons, Mag.-Magnolia, B.S.-Bon Secour, Gln.-Glenwood, Lan.-Lanaux, Race.-Raceland Sugars, R.H.-Ronald Hebert, StJ.-Levert-St. John.

‡ Percentage of locations where the variety was not significantly less than the highest yielding variety at that location.

§ $MSD_{0.05}$ - minimum significant difference at the $P \leq 0.05$ level.

Table 6. Plant-cane stalk populations for six commercial and four experimental varieties at eight outfield locations in 1995.

Variety	Heavy textured soil locations		Light textured soil locations						Mean	NS from best‡
	All.†	Mag.	B.S.	Gln.	Lan.	Race.	R.H.	StJ.		
	stalks acre^{-1}									%
CP65-357	19448	22662	19281	11445	14852	20610	15080	19512	17861	13
CP70-321	20023	22735	21505	17073	18206	22223	17483	18921	19771	13
CP72-370	20429	21053	27011	15250	17451	22022	19914	-----	20447	14
LHo83-153	22734	26554	23359	19257	19620	24997	19813	21187	22190	25
LCP85-384	24522	-----	23990	23344	21628	28006	24189	25642	24531	57
HoCP85-845	25035	24149	24926	-----	22208	26590	22287	20456	23664	29
HoCP88-739	18607	22780	20448	16116	16655	22249	17808	-----	19238	14
HoCP90-923	23028	27211	27709	21115	25235	32904	28276	25489	26087	100
HoCP90-941	15698	20690	18888	12661	17398	18921	16436	14808	16937	0
HoCP91-552	23440	26800	21758	17609	18856	28335	19853	24033	22585	38
Mean	21296	23663	22887	16856	19211	24402	20114	21256	21272	25
$MSD_{0.05}$§	4587	5076	2722	3371	2426	4036	4962	3132	1602	

† All.-A.V. Allain & Sons, Mag.-Magnolia, B.S.-Bon Secour, Gln.-Glenwood, Lan.-Lanaux, Race.-Raceland Sugars, R.H.-Ronald Hebert, StJ.-Levert-St. John.

‡ Percentage of locations where the variety was not significantly less than the highest yielding variety at that location.

§ $MSD_{0.05}$ - minimum significant difference at the $P \leq 0.05$ level.

Table 7. Plant-cane stalk weights for six commercial and four experimental varieties at eight outfield locations in 1995.

Variety	Heavy textured soil locations		Light textured soil locations						Mean	NS from best‡
	All.†	Mag.	B.S.	Gln.	Lan.	Race.	R.H.	StJ.		
	lbs.									%
CP65-357	2.90	3.03	2.43	2.50	3.23	2.83	3.07	2.47	2.81	75
CP70-321	2.20	3.17	2.37	2.53	2.87	2.73	2.57	2.17	2.58	38
CP72-370	2.57	3.33	2.17	2.60	2.83	2.70	2.57	----	2.68	14
LHo83-153	2.13	2.63	2.33	2.40	2.87	2.70	2.50	2.47	2.50	25
LCP85-384	2.23	----	2.30	2.40	2.67	2.57	2.60	2.13	2.42	14
HoCP85-845	2.33	3.13	2.27	----	3.00	2.73	2.87	2.10	2.63	57
HoCP88-739	2.53	3.03	2.63	2.73	3.03	2.97	2.77	----	2.81	71
HoCP90-923	1.93	2.40	1.70	1.87	2.17	2.20	1.93	1.93	2.01	0
HoCP90-941	2.67	3.13	2.60	2.93	3.23	3.27	3.13	2.57	2.94	10
HoCP91-552	2.10	2.63	2.13	2.23	2.80	2.33	2.47	1.87	2.32	0
Mean	2.36	2.94	2.29	2.47	2.87	2.72	2.65	2.21	2.57	25
$MSD_{0.05}$§	0.32	0.43	0.31	0.31	0.31	0.26	0.46	0.50	0.13	

† All.-A.V. Allain & Sons, Mag.-Magnolia, B.S.-Bon Secour, Gln.-Glenwood, Lan.-Lanaux, Race.-Raceland Sugars, R.H.-Ronald Hebert, StJ.-Levert-St. John.

‡ Percentage of locations where the variety was not significantly less than the highest yielding variety at that location.

§ $MSD_{0.05}$ - minimum significant difference at the $P \leq 0.05$ level.

Table 8. First ratoon sucrose yields for eight commercial and one experimental variety at nine outfield locations in 1995.

Variety	Heavy textured soil locations			Light textured soil locations						Mean	NS from best‡
	All.†	Mag.	Oak.	B.S.	Geo.	Gln.	Lan.	R.H.	StJ.		
	lbs acre^{-1}										%
CP65-357	6757	6169	----	6260	6093	----	5902	3628	6398	5887	0
CP70-321	5627	7514	3897	5505	7338	5712	7456	5047	5646	5853	33
CP72-370	5708	7721	----	6882	7597	4888	6160	3938	5323	6021	25
LCP82-089	5677	----	6124	7533	7745	4418	7746	----	6187	6531	29
LHo83-153	7062	5903	5446	7012	7940	6185	7968	5247	7165	6658	44
LCP85-384	8471	----	7502	8183	9848	6761	7880	5892	7992	7816	100
HoCP85-845	6499	7295	5593	7489	7945	5239	7743	6230	6764	6715	33
LCP86-454	6323	5289	5014	5942	7754	5383	8032	5246	6982	6218	22
HoCP88-739	7519	8288	6839	7018	8810	5226	7949	4959	----	7076	50
Mean	6663	6431	5774	6869	7897	5476	7465	5024	6548	6492	22
$MSD_{0.05}$§	792	955	917	833	593	667	915	2545	904	642	

† All.-A.V. Allain & Sons, Mag.-Magnolia, Oak.-Oaklawn, B.S.-Bon Secour, Geo.-Georgia, Gln.-Glenwood, Lan.-Lanaux, R.H.-Ronald Hebert, StJ.-Levert-St. John.

‡ Percentage of locations where the variety was not significantly less than the highest yielding variety at that location.

§ $MSD_{0.05}$ - minimum significant difference at the $P \leq 0.05$ level.

Table 9. First ratoon yields of cane for eight commercial and one experimental variety at nine outfield locations in 1995.

Variety	Heavy textured soil locations			Light textured soil locations						Mean	NS from best‡
	All.†	Mag.	Oak.	B.S.	Geo.	Gln.	Lan.	R.H.	StJ.		
	tons cane acre^{-1}										%
CP65-357	26.7	31.3	----	26.1	27.9	----	27.0	17.2	25.3	25.9	14
CP70-321	22.1	30.9	15.4	25.1	31.5	24.0	29.3	20.9	21.5	24.1	22
CP72-370	23.7	32.0	----	29.0	30.7	21.5	26.4	17.2	21.3	25.2	13
LCP82-089	21.9	----	24.4	31.4	32.6	21.8	32.5	----	24.2	27.2	29
LHo83-153	27.8	26.7	23.8	30.3	34.7	28.5	34.9	24.6	28.8	28.9	44
LCP85-384	31.3	----	29.1	33.0	38.6	28.5	31.5	22.9	30.3	30.7	88
HoCP85-845	26.7	32.2	23.8	33.1	34.6	25.2	35.1	28.3	26.9	29.4	56
LCP86-454	24.5	27.6	20.2	26.2	33.3	24.6	33.8	21.7	28.9	26.7	33
HoCP88-739	26.7	31.7	24.7	30.1	32.4	20.8	29.9	19.0	----	26.9	25
Mean	25.9	28.3	23.0	29.4	32.9	24.3	31.3	21.5	25.8	27.1	22
$MSD_{0.05}$§	3.2	4.4	4.2	2.6	3.0	2.6	3.1	9.9	4.1	2.3	

† All.-A.V. Allain & Sons, Mag.-Magnolia, Oak.-Oaklawn, B.S.-Bon Secour, Geo.-Georgia, Gln.-Glenwood, Lan.-Lanaux, R.H.-Ronald Hebert, StJ.-Levert-St. John.

‡ Percentage of locations where the variety was not significantly less than the highest yielding variety at that location.

§ $MSD_{0.05}$ - minimum significant difference at the $P \leq 0.05$ level.

Table 10. First ratoon sucrose content for eight commercial and one experimental variety at nine outfield locations in 1995.

Variety	Heavy textured soil locations			Light textured soil locations						Mean	NS from best‡
	All.†	Mag.	Oak.	B.S.	Geo.	Gln.	Lan.	R.H.	StJ.		
	sugar ton^{-1} cane										%
CP65-357	254	197	---	240	219	---	219	214	254	228	29
CP70-321	254	243	254	218	233	238	255	241	263	244	56
CP72-370	242	241	---	237	248	228	234	228	249	239	50
LCP82-089	259	---	251	240	237	203	238	---	256	240	57
LHo83-153	254	222	230	231	229	217	228	216	249	230	22
LCP85-384	271	---	258	247	257	237	251	256	264	255	88
HoCP85-845	244	227	236	226	230	207	221	221	252	229	22
LCP86-454	258	191	248	227	233	220	238	241	242	233	44
HoCP88-739	281	262	277	233	272	251	266	261	---	263	100
Mean	257	226	251	233	240	225	238	234	254	240	44
$MSD_{0.05}$§	23	27	12	23	18	19	33	27	21	9	

† All.-A.V. Allain & Sons, Mag.-Magnolia, Oak.-Oaklawn, B.S.-Bon Secour, Geo.-Georgia, Gln.-Glenwood, Lan.-Lanaux, R.H.-Ronald Hebert, StJ.-Levert-St. John.

‡ Percentage of locations where the variety was not significantly less than the highest yielding variety at that location.

§ $MSD_{0.05}$ - minimum significant difference at the $P \leq 0.05$ level.

Table 11. First ratoon stalk populations for eight commercial and one experimental variety at nine outfield locations in 1995.

Variety	Heavy textured soil locations			Light textured soil locations						Mean	NS from best‡
	All.†	Mag.	Oak.	B.S.	Geo.	Gln.	Lan.	R.H.	StJ.		
	stalks acre^{-1}										%
CP65-357	23671	23127	-----	22595	21888	-----	18821	17694	23100	21595	14
CP70-321	23748	23253	16610	23540	22900	21054	21147	19485	22452	21611	22
CP72-370	23980	25581	-----	28189	28407	19648	21593	19646	22744	23816	25
LCP82-089	22625	-----	28192	30006	28483	20506	26764	-----	28569	26640	14
LHo83-153	27276	22213	28007	25917	27254	25387	25887	24767	26564	25919	44
LCP85-384	31242	-----	32907	37947	32887	26675	30498	27642	38341	32267	100
HoCP85-845	27391	25126	27526	30014	27586	24022	26849	27655	27502	27066	56
LCP86-454	22026	16495	19258	18119	22335	17597	18534	16318	22338	19225	0
HoCP88-739	25468	24327	26836	25749	23768	16790	23049	17985	-----	22997	13
Mean	25371	21625	25619	26897	26167	21460	23856	21433	26406	24323	22
$MSD_{0.05}$§	4942	4134	4592	3913	2249	4439	3962	9429	5464	1946	

† All.-A.V. Allain & Sons, Mag.-Magnolia, Oak.-Oaklawn, B.S.-Bon Secour, Geo.-Georgia, Gln.-Glenwood, Lan.-Lanaux, R.H.-Ronald Hebert, StJ.-Levert-St. John.

‡ Percentage of locations where the variety was not significantly less than the highest yielding variety at that location.

§ $MSD_{0.05}$ - minimum significant difference at the $P \leq 0.05$ level.

Table 12. First ratoon stalk weights for eight commercial and one experimental variety at nine outfield locations in 1995.

Variety	Heavy textured soil locations			Light textured soil locations						Mean	NS from best‡
	All.†	Mag.	Oak.	B.S.	Geo.	Gln.	Lan.	R.H.	StJ.		
	lbs.										%
CP65-357	2.27	2.73	----	2.33	2.53	----	2.83	1.93	2.20	2.40	14
CP70-321	1.87	2.67	1.87	2.13	2.77	2.27	2.80	2.13	1.93	2.23	33
CP72-370	2.00	2.50	----	2.07	2.13	2.20	2.45	1.70	1.87	2.10	13
LCP82-089	1.95	----	1.70	2.13	2.30	2.17	2.43	----	1.70	2.06	14
LHo83-153	2.07	2.40	1.67	2.37	2.57	2.23	2.67	2.00	2.20	2.24	11
LCP85-384	2.03	----	1.77	1.73	2.33	2.13	2.13	1.67	1.57	1.92	13
HoCP85-845	1.97	2.57	1.73	2.20	2.50	2.10	2.60	2.07	1.95	2.18	11
LCP86-454	2.23	3.33	2.13	2.93	2.97	2.83	3.67	2.70	2.60	2.82	100
HoCP88-739	2.07	2.60	1.87	2.37	2.73	2.47	2.57	2.10	----	2.35	50
Mean	2.05	2.63	1.82	2.25	2.54	2.30	2.69	2.04	2.00	2.27	22
$MSD_{0.05}$§	ns	0.35	0.32	0.41	0.24	0.48	0.45	0.35	0.39	0.14	

† All.-A.V. Allain & Sons, Mag.-Magnolia, Oak.-Oaklawn, B.S.-Bon Secour, Geo.-Georgia, Gln.-Glenwood, Lan.-Lanaux, R.H.-Ronald Hebert, StJ.-Levert-St. John.

‡ Percentage of locations where the variety was not significantly less than the highest yielding variety at that location.

§ $MSD_{0.05}$ - minimum significant difference at the $P \leq 0.05$ level.

ns - no significant difference

Table 13. Second ratoon sucrose yields for nine commercial and one experimental variety at eight outfield locations in 1995.

Variety	Heavy textured soil locations		Light textured soil locations						Mean	NS from best‡
	All.†	Mag.	B.S.	Geo.	Gln.	Lan.	R.H.	StJ.		
	lbs sugar acre^{-1}									%
CP65-357	3984	6566	5256	5732	5374	5247	4408	5187	5254	13
CP70-321	3497	7039	5254	7331	5496	4697	3822	5662	5416	13
CP72-370	3880	5835	5638	6792	5357	5375	4327	4641	5216	13
CP74-383	3639	----	5202	5769	4569	6132	5313	4692	5045	0
LCP82-089	2314	7078	6133	6683	5020	4751	5166	5036	5109	13
LHo83-153	4680	5558	4967	6794	5754	5180	5726	6604	5658	25
LCP85-384	6238	----	6453	8984	8268	6984	5650	6810	7161	71
HoCP85-845	4013	5266	6506	7762	5444	6099	5325	5919	5833	25
LCP86-454	3527	5981	4598	6563	5560	6880	5089	6043	5530	38
HoCP88-739	5665	5881	7519	8159	6716	6589	7020	----	6889	86
Mean	4144	6162	5753	7057	5756	5793	5280	5510	5567	13
$MSD_{0.05}$§	627	2612	820	1235	1119	823	1037	815	643	

† All.-A.V. Allain & Sons, Mag.-Magnolia, B.S.-Bon Secour, Geo.-Georgia, Gln.-Glenwood, Lan.-Lanaux, R.H.-Ronald Hebert, StJ.-Levert-St. John.

‡ Percentage of locations where the variety was not significantly less than the highest yielding variety at that location.

§ $MSD_{0.05}$ - minimum significant difference at the $P \leq 0.05$ level.

Table 14. Second ratoon yields of cane for nine commercial and one experimental variety at eight outfield locations in 1995.

Variety	Heavy textured soil locations		Light textured soil locations						Mean	NS from best‡
	All.†	Mag.	B.S.	Geo.	Gln.	Lan.	R.H.	StJ.		
	tons cane acre^{-1}									%
CP65-357	20.1	26.2	24.0	24.7	23.8	23.4	23.8	24.5	23.8	13
CP70-321	16.7	27.2	21.8	28.8	22.0	19.3	18.9	23.0	22.3	13
CP72-370	18.2	21.1	24.0	26.7	21.7	22.9	21.9	19.7	22.0	13
CP74-383	17.7	----	25.1	26.6	19.4	27.3	28.6	22.9	23.9	29
LCP82-089	11.1	18.6	26.0	26.8	19.8	20.1	27.5	22.4	21.5	25
LHo83-153	23.6	23.5	22.8	29.9	27.2	23.2	29.2	30.4	29.2	38
LCP85-384	26.6	----	26.5	34.8	32.7	27.6	25.3	25.9	26.7	71
HoCP85-845	19.5	21.2	28.7	31.4	22.1	27.5	29.0	26.4	25.5	63
LCP86-454	16.8	24.4	23.8	27.3	25.2	26.4	25.6	25.4	24.4	25
HoCP88-739	22.5	16.8	27.9	29.4	25.9	25.3	31.2	----	25.6	57
Mean	19.3	20.8	25.1	28.6	24.0	24.3	26.6	24.4	24.1	25
$MSD_{0.05}$§	2.6	ns	2.3	4.0	3.2	3.0	5.3	3.7	2.8	

† All.-A.V. Allain & Sons, Mag.-Magnolia, B.S.-Bon Secour, Geo.-Georgia, Gln.-Glenwood, Lan.-Lanaux, R.H.-Ronald Hebert, StJ.-Levert-St. John.

‡ Percentage of locations where the variety was not significantly less than the highest yielding variety at that location.

§ $MSD_{0.05}$ - minimum significant difference at the $P \leq 0.05$ level.

ns - no significant difference

Table 15. Second ratoon sucrose content for nine commercial and one experimental variety at eight outfield locations in 1995.

Variety	Heavy textured soil locations		Light textured soil locations						Mean	NS from best‡
	All.†	Mag.	B.S.	Geo.	Gln.	Lan.	R.H.	StJ.		
	sugar ton^{-1} cane									%
CP65-357	198	251	219	233	227	226	185	213	220	13
CP70-321	209	260	241	253	250	244	202	247	240	75
CP72-370	213	241	235	255	247	235	197	236	233	38
CP74-383	206	---	208	217	234	225	185	205	212	14
LCP82-089	208	261	236	250	253	237	188	226	230	50
LHo83-153	198	236	218	227	212	223	196	218	216	0
LCP85-384	234	---	243	258	253	254	223	224	244	100
HoCP85-845	207	234	226	246	246	222	186	224	225	25
LCP86-454	209	245	194	241	218	258	199	238	225	50
HoCP88-739	252	276	269	278	259	259	226	---	258	100
Mean	213	248	229	246	240	238	199	226	230	63
$MSD_{0.05}$§	20	37	28	20	30	23	28	27	9	

† All.-A.V. Allain & Sons, Mag.-Magnolia, B.S.-Bon Secour, Geo.-Georgia, Gln.-Glenwood, Lan.-Lanaux, R.H.-Ronald Hebert, StJ.-Levert-St. John.
‡ Percentage of locations where the variety was not significantly less than the highest yielding variety at that location.
§ $MSD_{0.05}$ - minimum significant difference at the $P \leq 0.05$ level.

Table 16. Second ratoon stalk populations for nine commercial and one experimental variety at eight outfield locations in 1995.

Variety	Heavy textured soil locations		Light textured soil locations						Mean	NS from best‡
	All.†	Mag.	B.S.	Geo.	Gln.	Lan.	R.H.	StJ.		
	stalks acre^{-1}									%
CP65-357	21390	25038	25664	23400	24807	23286	23822	27112	24336	25
CP70-321	19290	21607	26762	25557	26292	18692	19892	26631	23229	25
CP72-370	22575	23116	27123	25925	24284	23480	24447	22929	24331	13
CP74-383	23511	-----	26189	25413	21360	26997	29808	27942	25888	43
LCP82-089	14180	26496	28503	26810	24367	20460	30968	28919	24960	25
LHo83-153	30137	23072	26060	27589	32543	23393	32125	33064	28498	38
LCP85-384	36118	-----	33347	35062	45232	30236	28785	32095	35213	100
HoCP85-845	24669	20655	34294	30078	27410	26092	26677	30275	27754	50
LCP86-454	18091	19713	17946	18387	22648	19722	21172	23266	20118	13
HoCP88-739	26630	19578	31442	25625	29695	26449	28242	-----	27570	29
Mean	23659	22282	27733	26385	27864	23881	26968	27939	25949	38
$MSD_{0.05}$§	3587	8228	4789	4396	4822	3444	7412	6696	2974	

† All.-A.V. Allain & Sons, Mag.-Magnolia, B.S.-Bon Secour, Geo.-Georgia, Gln.-Glenwood, Lan.-Lanaux, R.H.-Ronald Hebert, StJ.-Levert-St. John.

‡ Percentage of locations where the variety was not significantly less than the highest yielding variety at that location.

§ $MSD_{0.05}$ - minimum significant difference at the $P \leq 0.05$ level.

Table 17. Second ratoon stalk weights for nine commercial and one experimental variety at eight outfield locations in 1995.

Variety	Heavy textured soil locations		Light textured soil locations						Mean	NS from best‡
	All.†	Mag.	B.S.	Geo.	Gln.	Lan.	R.H.	StJ.		
	lbs.									%
CP65-357	1.87	2.10	1.90	2.10	1.93	2.00	2.00	1.80	1.96	38
CP70-321	1.77	2.53	1.70	2.27	1.70	2.03	1.95	1.73	1.96	25
CP72-370	1.63	2.10	1.77	2.03	1.80	1.97	1.80	1.73	1.83	0
CP74-383	1.53	----	1.90	2.10	1.83	2.03	1.93	1.67	1.86	0
LCP82-089	1.57	2.00	1.83	2.00	1.63	1.97	1.80	1.57	1.78	13
LHo83-153	1.57	2.00	1.73	2.17	1.67	2.00	1.83	1.83	1.85	0
LCP85-384	1.47	----	1.57	2.00	1.50	1.83	1.75	1.63	1.68	0
HoCP85-845	1.60	2.15	1.70	2.10	1.60	2.13	2.15	1.75	1.88	25
LCP86-454	1.87	2.47	2.67	2.97	2.23	2.67	2.43	2.20	2.44	100
HoCP88-739	1.67	2.20	1.80	2.30	1.77	1.93	2.20	----	1.96	29
Mean	1.65	2.23	1.86	2.20	1.77	2.06	2.00	1.77	1.93	25
$MSD_{0.05}$§	0.23	0.21	0.26	0.32	0.30	0.30	0.47	0.36	0.16	

† All.-A.V. Allain & Sons, Mag.-Magnolia, B.S.-Bon Secour, Geo.-Georgia, Gln.-Glenwood, Lan.-Lanaux, R.H.-Ronald Hebert, StJ.-Levert-St. John.
‡ Percentage of locations where the variety was not significantly less than the highest yielding variety at that location.
§ $MSD_{0.05}$ - minimum significant difference at the $P \leq 0.05$ level.

Table 18. Combined plant-cane means across outfield locations from 1993 through 1995.

Variety	Tests†	Sucrose yield		Cane yield		Sucrose content		Stalk populations		Stalk weight	
		Mean	NS from best‡	Mean	NS from best	Mean	NS from best	Mean	NS from best	Mean	NS from best
	no.	lbs./A	%	tons/A	%	lbs./ton	%	no./A	%	lbs.	%
CP65-357	26	6488	62	26.1	46	250	46	19997	23	2.6	38
CP70-321	27	6087	33	24.6	30	249	19	19515	15	2.5	22
CP72-370	26	6648	62	26.3	54	253	38	20976	42	2.5	12
LHo83-153	27	6367	52	26.5	56	241	11	22356	48	2.4	7
LCP85-384	27	7261	93	27.6	70	264	70	24103	74	2.3	4
HoCP85-845	26	6833	77	28.6	77	239	8	23160	58	2.5	19
HoCP88-739	25	6724	60	24.5	20	276	100	18607	8	2.6	36
Mean		6815		28.3		243		21928		2.6	
$MSD_{0.05}$§		341		1.3		5		1090		0.1	

† Number of tests in which the variety was harvested in 1993, 1994, and 1995.

‡ Percent of total tests the variety was not significantly different from the best variety for that trait in that test.

§ $MSD_{0.05}$ - minimum significant difference at the $P \leq 0.05$ level.

Table 19. Combined first ratoon means across outfield locations from 1993 through 1995.

Variety	Tests†	Sucrose yield		Cane yield		Sucrose content		Stalk populations		Stalk weight	
		Mean	NS from best‡	Mean	NS from best	Mean	NS from best	Mean	NS from best	Mean	NS from best
	no.	lbs./A	%	tons/A	%	lbs./ton	%	no./A	%	lbs.	%
CP65-357	29	5761	17	23.2	17	249	55	21216	10	2.2	31
CP70-321	31	5724	26	22.7	29	252	48	21229	13	2.2	42
CP72-370	30	6039	20	23.7	27	255	63	22873	17	2.1	27
LCP82-089	29	6373	28	25.4	41	251	55	25394	21	2.0	21
LHo83-153	31	6352	35	26.2	52	243	26	25814	39	2.0	23
LCP85-384	29	7698	97	29.1	83	265	90	32012	97	1.8	7
HoCP85-845	31	6377	35	26.4	48	243	26	25485	42	2.1	23
LCP86-454	31	6421	39	26.2	52	246	39	20160	3	2.6	71
Mean		6342		25.4		250		24238		2.1	
$MSD_{0.05}$§		323		1.2		4		1170		0.1	

† Number of tests in which the variety was harvested in 1993, 1994, and 1995.

‡ Percent of total tests the variety was not significantly different from the best variety for that trait in that test.

§ $MSD_{0.05}$ - minimum significant difference at the $P \leq 0.05$ level.

Table 20. Combined second ratoon means across outfield locations from 1993 through 1995.

Variety	Tests†	Sucrose yield		Cane yield		Sucrose content		Stalk populations		Stalk weight	
		Mean	NS from best‡	Mean	NS from best	Mean	NS from best	Mean	NS from best	Mean	NS from best
	no.	lbs./A	%	tons/A	%	lbs./ton	%	no./A	%	lbs.	%
CP65-357	24	4923	13	21.2	13	233	54	22058	13	1.9	42
CP70-321	25	5081	20	20.9	20	240	64	22024	12	1.9	32
CP72-370	25	5158	12	21.0	20	244	64	23305	8	1.8	24
CP74-383	24	5273	17	24.0	38	221	17	26780	29	1.8	17
LCP82-089	25	5367	16	23.0	36	234	44	26060	16	1.8	24
LHo83-153	24	5344	21	23.9	38	224	29	27396	21	1.7	13
LCP85-384	24	7266	88	28.7	88	255	100	36045	96	1.6	13
HoCP85-845	24	5887	46	24.9	58	237	50	27923	29	1.8	17
LCP86-454	25	5561	36	23.8	40	234	56	20488	12	2.3	100
Mean		5530		23.5		236		25705		1.9	
$MSD_{0.05}$§		372		1.4		5		1643		0.1	

† Number of tests in which the variety was harvested in 1993, 1994, and 1995.

‡ Percent of total tests the variety was not significantly different from the best variety for that trait in that test.

§ $MSD_{0.05}$ - minimum significant difference at the $P \leq 0.05$ level.

Table 21. Combined first ratoon means across outfield locations for 1994 & 1995.

Variety	Tests†	Sucrose yield		Cane yield		Sucrose content		Stalk populations		Stalk weight	
		Mean	NS from best‡	Mean	NS from best	Mean	NS from best	Mean	NS from best	Mean	NS from best
	no.	lbs./A	%	tons/A	%	lbs./ton	%	no./A	%	lbs.	%
CP65-357	17	6076	12	24.4	12	251	41	21132	12	2.3	18
CP70-321	19	6034	32	23.8	26	254	42	21823	21	2.2	26
CP72-370	18	6234	22	24.6	17	254	50	22647	22	2.2	28
LCP82-089	17	6623	35	26.1	35	254	47	24810	18	2.1	24
LHo83-153	19	6649	37	27.2	47	246	26	25074	42	2.2	16
LCP85-384	17	7708	94	29.1	71	266	82	30809	94	1.9	6
HoCP85-845	19	6849	47	28.1	53	245	26	25906	58	2.2	26
LCP86-454	19	6596	37	27.0	47	245	32	19751	5	2.8	53
HoCP88-739	17	7066	65	25.5	29	278	100	22838	18	2.2	35
Mean		6645		26.2		254		23826		2.2	
$MSD_{0.05}$§		420		1.5		5.3		1421		0.1	

† Number of tests in which the variety was harvested in 1993, 1994, and 1995.

‡ Percent of total tests the variety was not significantly different from the best variety for that trait in that test.

§ $MSD_{0.05}$ - minimum significant difference at the $P \leq 0.05$ level.

Table 22. Percentage of 1995 outfield plots in which each variety rated in the designated category of post-harvest scrap.

Variety	Crop	Amount of Scrap					Total
		None	Little	Some	Much	Very Much	
		percent of plots					no. of plots
CP65-357	PC	88	13				24
CP65-357	FR	86	10	5			21
CP65-357	SR	87	13				23
CP65-357	Mean	87	12	1			68
CP70-321	PC	88	4	8			24
CP70-321	FR	80	12	8			25
CP70-321	SR	91	9				23
CP70-321	Mean	86	8	6			72
CP72-370	PC	90	10				21
CP72-370	FR	78	17	4			23
CP72-370	SR	95	5				21
CP72-370	Mean	88	11	2			65
CP74-383	SR	95	5				21
LCP82-089	FR	85	15				20
LCP82-089	SR	100					22
LCP82-089	Mean	93	7				42
LHo83-153	PC	46	29	21	4		24
LHo83-153	FR	41	37	19	4		27
LHo83-153	SR	92	8				24
LHo83-153	Mean	59	25	13	3		75
LCP85-384	PC	55	15	15	5		20
LCP85-384	FR	33	13	25	25		24
LCP85-384	SR	61	28	6	6		18
LCP85-384	Mean	48	18	16	13	10	62
HoCP85-845	PC	86	14				21
HoCP85-845	FR	72	20	8			25
HoCP85-845	SR	100					21
HoCP85-845	Mean	85	12	3			67
LCP86-454	FR	96		4			27
LCP86-454	SR	100					24
LCP86-454	Mean	98		2			51
HoCP88-739	PC	95		5			21
HoCP88-739	FR	88	4	8			24
HoCP88-739	SR	95	5				19
HoCP88-739	Mean	92	3	5			64

THE 1995 LOUISIANA SUGARCANE VARIETY SURVEY

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Each year the Louisiana Cooperative Extension Service conducts variety surveys to determine the varietal makeup and distribution across the sugarcane acreage. As in previous years, the 1995 survey was conducted in June and July, near the middle of the growing season. Extension agents in each sugarcane-producing parish collected acreage figures by variety and crop year from growers in their parishes. Some information was also collected from the local FSA[1] office when the agents had difficulty in obtaining all the needed information from the growers. Since this information was collected during the growing season and included input from many persons, it may differ slightly from the final total crop acreage figures collected at harvest.

Acreages for each parish, regional totals, and the statewide total are shown in Table 1. The statewide total of 397,285 acres is up about 5,000 acres from the survey total for 1994. Regional totals were 171,834 acres for the Teche region, 165,102 for the River-Bayou Lafourche region and 60,349 acres for the Northern region in 1995. These totals indicate increases in acreage in each of the regions with the largest numerical and percentage increases occurring in the Northern region (5,759 acres or 10.5% increase over 1994).

Statewide acreages of each variety for each crop year and the total for each variety are shown in Table 2. The two leading varieties for 1994 remained at the top in 1995 with CP 70-321 and CP 65-357 making up 49.4% and 15.0%, respectively, of the total acreage. LCP 82-89 and CP 72-370 made up 12.6% and 8.9%, respectively, of the total acreage. No other variety contributed more than 5% of the acreage.

Acreage distribution by region and crop year are shown in Table 3. The total acreage for each region and for the entire state was made up of almost equal percentages of plant cane, first stubble, and second stubble and older (the three categories used to classify crop year). Readjustments of the cropping cycle following the disruptive effect of the 1989-90 freeze appear to be complete.

Varietal makeup by crop year is shown for the Teche, River-Bayou Lafourche, and Northern regions in tables 4,5, and 6 respectively. Approximately two-thirds (67.1%) of the acreage in the Teche region was planted to CP 70-321. Other varieties that contributed 5% or more of the total acreage in this region were LCP 82-089 (11.6%) and CP 65-357 (5.6%). In the River-Bayou Lafourche region, CP 70-321 was the most prevalent variety with 28.7% of the total acreage. This is the first time in recent years that acreage of CP 70-321 was larger than

[1] ASCS was changed to Consolidated Farm Services Agency in November 1994 and to Farm Services Agency in November 1995.

that of CP 65-357. CP 65-357 was second in acreage, occupying 24.0% of the total acreage. Other varieties that occupied 5% or more of the total acreage in this region included LCP 82-089 (15.7%), CP 72-370 (13.9%), and CP 74-383 (5.8%). In the Northern region, the leading variety was CP 70-321, with 55.7% of the total acreage. Other varieties that contributed 5% or more of the total acreage included CP 65-357 (17.5%), CP 72-370 (7.7%), and LCP 82-89 (6.6%).

Sugarcane variety trends over the last five years are shown in Table 7. One of the most obvious trends is the declining contribution of CP 65-357 over this period. It has dropped from 29% of the total acreage in 1992 to 15% in 1995. During the five-year period, CP 70-321 remained at about 45% to 49% of the total acreage. Some of the varieties included in the survey have become available to growers for the first time during this period and are being grown on small but increasing percentages of the acreage. Acreage devoted to LCP 82-89 has increased from less than 1% of the acreage in 1991 to 13% of the total in 1995. Others have shown smaller increases, perhaps because they have been available for shorter periods.

These changes suggest that growers have become less enthusiastic about growing some of the older varieties, particularly CP 65-357 and CP 72-356. These varieties are being replaced by newer, high yielding varieties with good ratooning ability.

Table 1. Estimated Total Sugarcane Acres by Parish and Region, 1995[1].

Teche Region		River-Bayou Lafourche Region		Northern Region	
Parish	Acres	Parish	Acres	Parish	Acres
Acadia	540.9	Ascension	16,689.0	Avoyelles	14,290.0
Iberia	58,500.0	Assumption	37,200.0	East Baton Rouge	742.4
Lafayette	11,197.3	Iberville	33,721.5	Evangeline	300.0
St. Martin	32,373.2	Lafourche	32,200.0	Pointe Coupee	19,548.8
St. Mary	44,416.2	St. Charles	2,230.0	Rapides	4,146.7
Vermilion	24,806.0	St. James	23,515.0	St. Landry	7,471.0
		St. John	8,731.9	West Baton Rouge	13,850.1
		Terrebonne	10,815.0		
TOTAL	171,833.6	TOTAL	165,102.4	TOTAL	60,349.0
Total-All Regions: 397,285.0 Acres					

[1] Based on 1995 variety survey information from county agents

Table 2. Estimated Sugarcane Acreage by Variety and Crop Year, 1995[1].

Variety	Plant Cane (%)	1st Stubble (%)	2nd Stubble & Older (%)	Total (%)
CP 65-357	10.9	17.0	17.7	15.0
CP 70-321	47.2	47.4	53.7	49.4
CP 72-370	9.3	8.7	8.7	8.9
CP 74-383	2.0	4.0	4.7	3.5
CP 76-331	0.2	0.2	0.5	0.3
CP 79-318	2.4	2.8	2.1	2.4
LCP 82-89	15.5	12.3	9.7	12.6
LHo 83-153	4.2	4.3	1.9	3.5
LCP 85-384	6.5	1.8	0.3	3.0
HoCP 85-845	0.9	0.4	0.3	0.5
LCP 86-454	0.4	0.1	Tr.	0.2
Others	0.5	1.0	0.5	0.7
Total	100.0	100.0	100.1	100.0

[1] Based on 1995 variety survey information from county agents.

Table 3. Estimated Sugarcane Distribution by Region and Crop Year, 1995[1].

Harvest Year	Teche	River-Bayou Lafourche	Northern	State Total
Plant Cane				
Acres	62,185	60,858	20,548	143,591
%	36.2	36.9	34.0	36.1
1st Stubble				
Acres	53,191	50,622	16,545	120,358
%	31.0	30.7	27.4	30.3
2nd Stubble and Older				
Acres	56,457	53,622	23,256	133,336
%	32.9	32.5	38.5	33.6
Total				
Acres	171,834	165,102	60,349	397,285
%	100.1	100.1	99.9	100.0

[1] Based on 1995 variety survey information from county agents

Table 4. Estimated Teche Region Acreage by Variety and Crop Year, 1995[1].

Variety	Plant Cane (%)	1st Stubble (%)	2nd Stubble & Older (%)	Total (%)
CP 65-357	3.8	5.2	7.8	5.6
CP 70-321	64.5	66.7	70.4	67.1
CP 72-370	4.8	5.2	3.8	4.6
CP 74-383	0.7	1.6	1.6	1.3
CP 76-331	Tr.	Tr.	Tr.	Tr.
CP 79-318	2.7	2.3	2.0	2.4
LCP 82-89	12.4	11.5	10.8	11.6
LHo 83-153	2.8	3.0	2.0	2.6
LCP 85-384	6.2	2.0	0.1	2.9
HoCP 85-845	0.6	0.4	0.5	0.5
LCP 86-454	0.4	0.1	Tr.	0.2
Others	0.9	1.8	1.0	1.2
Total	99.8	99.8	100.0	100.0

[1] Based on 1995 variety survey information from county agents.

Table 5. Estimated River-Bayou Lafourche Region Sugarcane Acreage by Variety and Crop Year, 1995[1].

Variety	Plant Cane (%)	1st Stubble (%)	2nd Stubble & Older (%)	Total (%)
CP 65-357	18.3	30.0	24.8	24.0
CP 70-321	26.3	23.5	36.4	28.7
CP 72-370	15.1	13.2	13.3	13.9
CP 74-383	3.4	6.3	7.9	5.8
CP 76-331	0.1	0.4	0.4	0.3
CP 79-318	1.9	2.9	2.3	2.3
LCP 82-89	20.3	14.6	11.7	15.7
LHo 83-153	6.4	6.4	2.5	5.1
LCP 85-384	6.2	1.7	0.4	2.9
HoCP 85-845	1.3	0.4	0.2	0.6
LCP 86-454	0.5	0.1	Tr.	0.2
Others	0.2	0.6	0.1	0.3
Total	100.0	100.1	100.0	99.8

[1] Based on 1995 variety survey information from county agents.

Table 6. Estimated Northern Region Sugarcane Acreage by Variety and Crop Year, 1995[1].

Variety	Plant Cane (%)	1st Stubble (%)	2nd Stubble & Older (%)	Total (%)
CP 65-357	10.4	15.3	25.4	17.5
CP 70-321	56.7	58.3	53.1	55.7
CP 72-370	5.9	6.5	10.1	7.7
CP 74-383	2.0	4.1	5.0	3.7
CP 76-331	0.8	0.4	1.7	1.0
CP 79-318	2.5	3.9	2.0	2.7
LCP 82-89	10.6	8.0	2.1	6.6
LHo 83-153	2.1	2.1	0.4	1.4
LCP 85-384	8.2	1.3	0.3	3.2
HoCP 85-845	0.8	0.1	Tr.	0.3
LCP 86-454	0.1	Tr.	Tr.	Tr.
Others	Tr.	Tr.	Tr.	Tr.
Total	100.1	100.0	100.1	99.8

[1] Based on 1995 variety survey information from county agents.

Table 7. Louisiana Sugarcane Variety Trends, 1991-1995[1].

Variety	% of State Total Acreage by Year					1 yr. change
	1991	1992	1993	1994	1995	
CP 65-357	29	29	25	22	15	-7
CP 70-321	47	48	45	47	49	+2
CP 72-356	0.8	–	–	–	–	–
CP 72-370	10	9	11	10	9	-1
CP 74-383	6	5	5.3	5	4	-1
CP 76-331	2.1	1.6	1.6	1	<1	-<1
CP 79-318	4.4	4.0	3.5	3	2	-1
LCP 82-89	0.5	1.9	5.9	8	13	+5
LHo 83-153	–	0.3	1.4	3	4	+1
LCP 85-384	–	–	–	1	3	+2
HoCP 85-845	–	–	–	–	<1	+<1
LCP 86-454	–	–	–	–	<1	+<1
Others	0.9	1.0	0.7	1	<1	-<1
Total	100	100	100	100	100	–

[1] Based on variety survey reports from county agents in sugarcane-producing parishes, 1991-1995

SUCROSE LABORATORY AT ST. GABRIEL

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Over 3,000 samples were processed at the St. Gabriel Sucrose Laboratory during the 1995 harvest season (Table 1). Standard laboratory procedures, which include use of the ABC Clarifier, were used to measure the sucrose content of the juice. The juice was extracted via a three-roller mill for most of the samples (3,322). Fiber analysis was performed on 73 samples via chip/press extraction. The pol and brix results were recorded and the laboratory numbers were recorded on the sample tags.

Table 1. Number of sugarcane samples processed at the St. Gabriel Sucrose Laboratory during the 1995 harvest season.

PROJECT AREA/LEADER	NUMBER OF SAMPLES
Cultural Practices and Fertility	
Ricaud	559
Hallmark	437
Viator	98
Selim	36
Entomology	56
Plant Pathology	84
Weed Science	274
Variety Program	
Infield	62
Line Trial	1,141
Nursery	319
Nursery (fiber)	73
Maturity Test	256
TOTAL	3,395

This project was partially funded by the American Sugar Cane League.

SUGARCANE TISSUE CULTURE LABORATORY - 1995 PRODUCTION REPORT

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Crop Genetics International Corporation and Sugar Station/Audubon Sugar Institute

On February 1995, an agreement between Louisiana Agricultural Experiment Station (LAES), Louisiana State University Agricultural Center (LSU Ag. Center), and Crop Genetics International Corporation (CGI, currently a Division under Biosys Inc.) was established to provide for cooperation between LAES and CGI to advance sugarcane technology for the benefit of the Louisiana sugarcane industry and to further develop the techniques for mass propagation of healthy sugarcane via tissue culture.

Based on this agreement, LAES Sugarcane Tissue Culture Laboratory, with the equipment donated by CGI, was established on March 1995 in room 118 of H. D. Wilson Building on the LSU Baton Rouge campus. Mass production of disease-free seedcane started on July 15, 1995.

Two tissue culture production methods, leaf roll callus production and meristem production, were used. With leaf roll production method, a small piece of cane (leaf spindle tissue) was cut from an area just above the growing point (apical meristem) of disease-free foundation stock. After surface sterilization, the cane spindle piece was cut into thin cross-sections. These small cane pieces were then placed on solid medium for callus induction. After a few weeks, calli derived from leaf spindle tissue were transferred to plant regeneration media. After shoot elongation and root development, plantlets with well-developed roots were directly transplanted into the greenhouse or placed in the long-term storage incubator. Although callus production method is simple, reliable, and cost saving, the somaclonal variation (offtype) frequency for certain cultivars can be high.

Offtype incidence was minimized with the meristem production method. The meristematic dome was aseptically removed from the sugarcane tip, then placed in liquid medium to induce shoot development. The liquid medium was changed frequently. After several weeks, shoots were transferred to solid multiplication medium. Cultures were subcultured biweekly until desired plantlet numbers had been achieved. The plantlets were then transferred to rooting medium. Contamination in plantlet production was minimum. More than 40,000 plantlets were regenerated during the 1995-96 production season in this newly established sugarcane tissue laboratory. Under terms of the agreement, 33,991 plantlets were turned over to Kleentek for transplanting into the greenhouse (table 1). The average greenhouse survival rate of the plantlets was 94%.

Table 1. Plantlet production in the LAES Sugarcane Tissue Culture Laboratory for 1995.

Cultivar	Leaf roll callus culture	Meristem culture
CP65357		1,570
CP70-321		7,416
CP72-370	1,152	
CP79-318	1,368	
LCP82-89		6,617
LHo83-153	360	2,318
LCP85-384	216	5,486
HoCP85-845	1,548	4,241
LCP86-454	1,346	353

INTRAROW PLANT SPACING AND FAMILY BY ENVIRONMENT INTERACTION EFFECTS ON SUGARCANE CROSS EVALUATION

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SUMMARY

Research to optimize sugarcane progeny testing or cross appraisal methodology indicates that use of more widely spaced plants in the appraisal test could increase selection effectiveness by nearly 30% compared to using the standard intrarow plant spacing. Results from 1995 and previous results suggest that cross by location interaction is only a minor inhibitor of selection effectiveness, but residual within-field variance is by far the largest source of variance. Much of this within-field variance is within family genetic variation, upon which selection will be imposed.

INTRODUCTION

Cross appraisal is the evaluation of progeny from the hybridization of two parents to measure the cross's potential to produce elite individuals. Appraisal data are used to select the best crosses prior to individual plant selection and to guide crossing and seedling planting decisions. The more accurate the data, the more accurate selection decisions will be. The general objective of this work is to measure the affect of "controllable" environmental effects on the precision of the cross appraisal testing and selection scheme. These effects (years, locations, replications, rows, plants, and stalks measured) are controllable in the sense that the number of replications of these effects can be modified to optimize the degree of precision within the resource constraints of the program.

OBJECTIVES

This research has two primary goals. One goal is to identify the effect of location, year, replication, row, plant, and stalk numbers measured on the precision of the appraisal test. The current method uses one location, two replications per location, two rows per replication, and 16 plants per row. Stalk numbers are based upon all plants while stalk weights are estimated from stalk heights and diameters of five stalks per row. A second objective is to evaluate the improvement in test precision that using a wider intrarow plant spacing (81 cm) would provide compared to the standard plant spacing (41 cm).

MATERIALS AND METHODS

In 1995, progeny from 25 crosses planted at two locations in 1994 were replanted in April 1995 at the LAES St. Gabriel Research Station and the USDA Ardoyne Farm. Trials were planted in the same manner as in 1994, namely for each location, spacing and plot, two rows of 16 plants each were transplanted. Approximately 60 total plants were planted from each cross at each location, year, and plant spacing. Stalks per plant, two stalk heights, and two stalk diameters per plant for each plant were recorded in August 1995 for the progeny planted in April

1994 (first ratoon plants).

RESULTS AND DISCUSSION

A coefficient of variation (CV) is the ratio of the standard deviation to the mean expressed as a percentage. An experiment with a lower CV is more precise than one with a higher CV. Analysis indicates that, for most traits, crosses evaluated at wider spacing demonstrated lower CVs than those that used narrower spacings (Table 1; Milligan, 1995). This suggests tests with widely spaced plants would be more precise than those with narrowly spaced plants.

Analysis of variance indicates that cross by location interaction (CL) was significant for several traits and spacings although the negative contribution to selection effectiveness by the CL is likely negligible (Tables 2 and 3; Milligan, 1995; Zaunbrecher, 1995). The residual within field variance is clearly the largest source of variation. It should be noted that a large portion of this residual variance is within family genetic variance, which is the primary source genetic variation contributing to genetic gain (Zaunbrecher, 1995).

The cross CV is an indication of the amount of genetic variability available for selection. The cross CV increased with wider intrarow plant spacing compared to the narrower spacing. Although the actual genetic variability should be the same among crosses regardless of the plant spacing, it is speculated that the wide spacing provided a less competitive environment in which the crosses could better express their potential. There is a physical limit to the number of stalks that can grow in a field row. The normal spacing commonly crowds plants together so that the potential stalk number per plant cannot fully express itself.

The estimate of gain from selection is the bottom-line estimate of improved selection efficiency using the different plant spacings. Selection for plant weight, an indicator of cane yield, improved from 11.2% to 14.5% by using wider plant spacings. This is a 29% increase in selection effectiveness by using the wider spacing. Analysis indicates that cross by spacing interaction for plant weight was significant at the 10% level (results not shown). The importance of this interaction will be determined by further analysis of the current data and that to be collected in August 1996.

REFERENCES

Milligan, S. B. 1995. Intrarow plant spacing and family by environment interaction effects on sugarcane cross evaluation. LAES Sugarcane Research Annual Progress Report for 1994. p131-136.

Zaunbrecher, R., 1995. Improving selection procedures in sugarcane using cross appraisal methods. M.S. Thesis. Louisiana State University. 124p.

Table 1. First ratoon means, standard deviations, and coefficients of variation for cane yield components of 25 biparental sugarcane families measured at two locations in August 1995.

Location	Plant Spacing	Cane yield component†				
		Plant weight	Stalks plant^{-1}	Stalk weight	Stalk diameter	Stalk length
		kg	no.	kg	mm	cm
Ardoyne Farm	Narrow	6.05±4.71 (78)	9.45±6.26 (66)	0.62±0.26 (42)	20.5±3.4 (17)	176±31 (18)
Ardoyne Farm	Wide	9.40±5.77 (61)	14.63±7.24 (49)	0.63±0.26 (41)	21.0±3.4 (16)	170±32 (19)
St. Gab. Res. Stn.	Narrow	5.40±4.30 (80)	10.44±6.88 (66)	0.50±0.20 (41)	20.4±3.2 (16)	143±31 (22)
St. Gab. Res. Stn.	Wide	9.44±6.32 (67)	16.66±8.02 (48)	0.55±0.24 (44)	22.0±3.7 (17)	135±29 (21)
Ardoyne Farm	Mean	7.74±5.53 (71)	12.07±7.25 (60)	0.63±0.26 (41)	20.8±3.4 (17)	173±32 (18)
St. Gab Res. Stn.	Mean	7.48±5.79 (78)	13.63±8.10 (59)	0.52±0.22 (43)	21.2±3.6 (17)	139±30 (22)
Mean	Narrow	5.73±4.53 (79)	9.93±6.59 (66)	0.56±0.24 (43)	20.5±3.3 (16)	160±35 (22)
Mean	Wide	9.42±6.05 (64)	15.64±7.70 (49)	0.59±0.25 (43)	21.5±3.6 (17)	153±35 (23)
Mean	Mean	7.61±5.66 (74)	12.84±7.72 (60)	0.58±0.25 (43)	21.0±3.5 (17)	156±35 (23)

† Mean ± standard deviation (coefficient of variation).

Table 2. Variance components, means, cross coefficients of variation, gain from cross selection for stalk number, and plant weight at two intrarow plant spacings.

Source	Stalks number		Plant weight	
Plant spacing	Narrow	Wide	Narrow	Wide
	(stalks plant^{-1})^2		kg^2	
Cross	1.009** ± 0.517	3.328** ± 1.345	0.966** ± 0.425	3.607** ± 1.344
Cross*location	0.455* ± 0.339	0.064 ± 0.482	0.074 ± 0.212	-0.197 ± 0.37
Row(cross loc rep)	-0.883 ± 0.264	0.609 ± 0.583	-0.023 ± 0.204	1.331** ± 0.515
Residual	42.683 ± 1.344	54.943 ± 1.715	19.533 ± 0.856	32.44 ± 1.237
	stalks plant^{-1}		kg	
Mean	9.93	15.64	5.73	9.42
	%			
Cross CV	10.1	11.7	17.2	20.2
Gain with 50% cross selection intensity†	5.5	7.8	11.2	14.5

*, ** Mean square was significant at the P ≤ 0.05 and 0.01 level, respectively.
† Gain from selection assumes one location, two replications, five plants per row are measured.

Table 3. Variance components, means, cross coefficients of variation, gain from cross selection for stalk length, stalk diameter, and stalk weight at two intrarow plant spacings.

Source	Stalk length		Stalk diameter		Stalk weight	
Plant spacing	Narrow	Wide	Narrow	Wide	Narrow	Wide
	cm^2		mm^2		(kg x 10^{-2})^2	
Cross	172.6**	205.8**	0.993**	1.103**	0.57**	0.74 **
	±51.5	±60.0	±1.027	±1.029	21.51	±26.10
Cross*location	9.7*	0.1	-0.02	0.261**	0.06*	0.02
	±7.2	±6.2	±0.242	±0.191	3.65	±1.75
Row(cross loc rep)	19.9**	41.4**	0.081	0.221	-0.01	0.14**
	±7.1	±9.5	±0.094	±0.406	2.41	±4.99
Plant(row cross rep loc)	493.4**	506.2**	6.545**	7.302**	2.99**	3.46**
	±1.2	±1.1	±0.064	±0.064	6.80	±0.69
Residual	330.1	271.4	5.652	6.15	2.92	3.00
	±9.1	±7.2	±0.627	±0.549	6.10	±5.41
	cm		mm		kg	
Mean	160	153	20.5	21.5	0.56	0.59
	%					
Cross CV	8.2	9.4	4.9	4.9	13.4	14.6
Gain with 50% cross selection intensity†	5.8	6.8	3.2	2.9	8.8	9.8

*, ** Mean square was significant at the P ≤ 0.05 and 0.01 level, respectively.
† Gain from selection assumes one location, two replications, five plants per row; two stalks per plant are measured.

BROAD-SENSE HERITABILITY AND GENETIC CORRELATIONS FOR SUGARCANE BORER RESISTANCE EVALUATION TRAITS

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The sugarcane borer, *Diatraea saccharalis*, causes the majority of insect-related damage to Louisiana sugarcane. Cultivar resistance potentially provides the most economic and environmentally effective means of control available to the production industry. Entomologists measure a number of variables to evaluate cultivar resistance, but genetic knowledge concerning these traits and their interrelationships is lacking. Despite the considerable work elucidating plant resistance mechanisms and epidemiological dynamics, the broad-sense genetic behavior of commonly appraised traits for borer resistance has not been evaluated. Given the considerable effort expressed in obtaining resistance data, work seemed warranted toward interpreting and integrating the multidimensional information. In short, how heritable are the commonly made measures of resistance? How genetically related are they? What is the best way to integrate this knowledge and how might they most effectively be measured?

MATERIALS AND METHODS

Louisiana sugarcane clones are first objectively screened for borer resistance six years after crossing. This is the inference population. Twenty-eight experimental clones from the LAES 1993 assignment series and four commercial checks were planted at the Glendale Plantation near Lucy, LA, and the LAES St. Gabriel Research Station in fall 1994. Clones were planted in single row plots (1.8 m by 4.3 m) using a four block randomized complete block design at each location. Four check varieties were replicated within each block. Plant cane data were recorded in November 1995.

Between the LAES and USDA borer resistance screening programs three types of data are collected: percent bored internodes, percent exited internodes, and a damage rating. These data are used to further calculate a pupation success rate and moth production per area. Prior to sampling, total stalk number per plot and a damage rating were recorded. The damage rating was developed by W. H. White (White per. comm.- 1995; Table 1). Percent bored and exited internodes were recorded from 15 stalks per plot. The pupation success rate was estimated as:

Pupation success rate = 100 (exited internodes per stalk)/ (bored internodes per stalk).

The moth production per area is defined as:

Moth production = (stalks per area)(exited internodes per stalk).

Table 1. Rating system to evaluate sugarcane borer damage†.

Rating	Description
	Resistant
1	< 30% of stalks with leaf-sheath feeding signs
2	30 to 60% of stalks with leaf-sheath feeding signs
3	> 60% of stalks with leaf-sheath feeding signs; isolated lateral shoots may be
	Intermediate
4	< 30% of stalks with lateral shoots, and with or without leaf-sheath feeding
5	30 to 60% of stalks with lateral shoots, and wide-spread leaf-sheath feeding
6	> 60% of stalks with lateral shoots and wide-spread leaf-sheath feeding signs
	Susceptible
7	Same as 6, and with < 30% of stalks with dead tops or broken tops
8	Same as 6, and with 30 to 60% of stalks with dead tops or broken tops
9	Same as 6, and with > 60% of stalks with dead tops or broken tops

† Developed by W. H. White, USDA-ARS; Sugarcane Res. Unit; Houma, LA.

Analysis among and within locations assumed a completely random model for genetic analysis and assumed genotypes fixed for the cultivar evaluation. Variance components were estimated for % bored internodes, damage rating, % exited internodes, pupation success rate, moth production, and a damage rating. Broad-sense heritability (H) estimates were calculated as intraclass correlations for three scenarios: (1) unreplicated plot, (2) four replications and one location, and (3) two replications and two locations. The heritability was calculated as:

$$H = \sigma_G^2 / (\sigma_G^2 + \sigma_{GL}^2 / l + \sigma_E^2 / rl)$$

with the variance components genotype (σ_G^2), genotype by location (σ_{GL}^2), and residual (σ_E^2), and the divisor l is the number of locations, and r is the number of replications for the scenario.

The genetic variability of the examined traits was expressed as the genetic variance, σ_G^2, and the genetic coefficient of variation (GCV):

$$GCV = 100\ \sigma_G / \text{mean}.$$

Potential genetic gain (GA) for the traits was also expressed as the percentage of the mean as:

$$GA = 100\ i\ H\ \sigma_P / \text{mean}$$

where i is the standardized selection intensity and σ_P is the phenotypic standard deviation for the

examined scenario. The σ_P^2 is the denominator of the corresponding heritability.

Broad-sense genetic correlations (r_G) among the traits were calculated as:

$$r_G = \sigma_{ij}/\sigma_i\sigma_j$$

where σ_{ij} is the genetic covariance among traits *i* and *j*, σ_i and σ_j are the genetic standard deviations of traits *i* and *j*, respectively.

RESULTS

Borer infestation levels varied considerably among locations with the Glendale Plantation (normal LAES testing site) displaying much higher levels of borer infestation (33% mean bored internodes; Table 2) than the St. Gabriel Research Station (10% mean bored internodes; Table 3). Pupation success was interestingly higher at St. Gabriel than at Glendale. All traits but the number of internodes and pupation success showed significant genotype by location interaction for all traits (Table 5). Of the specific evaluation traits, exited internodes promised the highest potential for improvement while selection with the damage rating showed the least potential. Selection schemes employing multiple locations at the expense of replications within locations ($GA_{2,2}$) were more effective than replicating within locations ($GA_{1,4}$) (Table 5).

Traits were generally well correlated among themselves with the pupation success being very strongly correlated to all traits except the number of internodes and stalk number (Table 6). Surprisingly, moth production was not highly correlated to stalk number and more strongly correlated to other resistant measures. This suggests an index to breed against moth production may succeed without necessarily decreasing stalk number, which is the most important contributor to cane yield production. This research will be continued in 1995 to estimate genotype by year interaction effects and estimate genetic parameters less biased by such interaction. The ultimate goal of this work will be to use the information to develop more efficient testing procedures and optimum selection indices appropriate to the kind of evaluation data collected.

Acknowledgment: We thank Dr. Gene Reagan, Lance Rodriguez, Ed Ostheimer, Andy Woolwine, and Harry Schexnayder, Jr., for helping to collect the borer damage data. We also thank Dr. Keith Bischoff, Patrick Rodriguez, and Kenny Quebedeaux for aiding in cutting the tests.

Table 2. Mean plant cane variety reaction to the sugarcane borer at Glendale Plantation in 1995.

Variety	Internodes	Bored internodes	Exited internodes	Pupation success	Stalk number	Moth production	Rating
	$stalk^{-1}$	----- % internodes -----		%	---------- m^{-2} ----------		unitless
CP70-321	17.0	19	5	20	7.99	5.91	5.4
CP74-383	13.8	43	12	28	8.57	13.72	7.8
LCP82-89	14.5	27	6	21	8.64	6.63	5.6
LCP85-38	16.6	32	9	26	10.86	15.01	5.9
L93-358	16.2	27	6	21	7.99	7.06	5.3
L93-363	15.8	35	10	25	7.06	10.26	6.8
L93-364	16.0	19	4	15	7.96	4.64	3.8
L93-365	13.7	48	13	25	7.20	12.75	7.8
L93-366	14.1	31	7	23	12.89	12.31	7.3
L93-371	15.7	36	7	20	6.05	6.23	6.5
L93-372	15.9	36	8	21	8.01	9.19	4.3
L93-374	15.3	36	10	28	7.52	11.14	6.0
L93-376	14.4	35	9	22	7.93	8.51	5.8
L93-378	15.5	39	9	23	8.02	10.44	7.2
L93-380	16.6	28	6	22	6.59	6.57	7.3
L93-382	16.2	38	13	31	6.98	13.98	7.8
L93-385	14.6	34	7	20	8.95	8.82	6.5
L93-386	15.8	31	12	37	6.75	12.72	6.3
L93-387	13.7	46	10	21	6.75	8.41	8.0
L93-388	15.6	41	10	25	8.57	13.39	7.5
L93-390	15.2	26	5	17	8.24	6.38	6.8
L93-391	18.8	32	7	21	5.97	7.85	6.5
L93-393	18.6	18	4	27	8.04	5.85	4.8
L93-394	12.8	38	9	21	8.49	8.66	7.0
L93-395	18.3	23	5	20	7.96	6.74	5.0
L93-396	15.4	47	19	38	7.96	21.68	7.5
L93-397	17.7	46	14	28	6.11	14.04	7.3
L93-398	14.5	38	17	46	6.27	14.61	8.0
L93-399	17.5	38	10	27	6.86	12.14	5.5
L93-400	13.7	48	13	28	9.24	15.93	7.5
L93-401	21.3	28	6	22	7.65	8.59	4.5
L93-402	15.6	19	4	18	8.60	5.45	4.3
Mean	15.8	33	9	24	8.02	10.16	6.3
$LSD_{0.05}$	2.1	10	6	12	1.91	6.16	1.5

Table 3. Mean plant cane variety reaction to the sugarcane borer at the St. Gabriel Research Station in 1995.

Variety	Internodes	Bored internodes	Exited internodes	Pupation success	Stalk number	Moth production	Rating
	stalk^{-1}	----- %internodes ------		%	----------	m^{-2} ----------	unitless
CP70-321	14.6	6	2	33	6.65	1.95	3.0
CP74-383	12.6	12	6	40	7.89	5.43	3.3
LCP82-89	12.5	14	6	43	7.30	5.69	2.4
LCP85-384	14.0	8	4	42	10.36	5.49	2.3
L93-358	14.2	10	4	40	7.00	4.09	2.3
L93-363	13.1	15	7	47	7.96	6.54	2.5
L93-364	12.7	4	1	14	8.21	0.54	2.0
L93-365	12.3	13	5	40	6.16	3.64	2.3
L93-366	12.6	10	2	17	8.43	2.17	2.3
L93-371	14.5	16	5	25	5.88	4.76	3.3
L93-372	13.8	4	2	36	6.75	1.93	1.8
L93-374	13.0	9	3	33	9.41	3.95	2.3
L93-376	12.8	14	6	39	7.09	5.44	2.5
L93-378	12.2	12	4	36	8.65	4.00	2.5
L93-380	13.4	9	4	45	5.32	2.80	2.5
L93-382	13.9	8	5	53	5.66	3.60	3.0
L93-385	13.5	20	11	53	7.26	11.17	3.8
L93-386	12.2	9	5	40	7.99	4.36	2.3
L93-387	12.7	8	4	56	7.48	4.02	2.5
L93-388	13.3	6	2	28	7.54	1.70	2.0
L93-390	12.6	7	3	35	7.15	2.32	2.3
L93-391	16.6	13	4	23	6.25	3.82	2.3
L93-393	15.2	5	2	29	7.54	1.69	2.0
L93-394	11.7	5	2	36	6.92	1.34	2.3
L93-395	14.7	8	3	31	7.99	3.18	1.8
L93-396	14.2	19	10	47	6.86	9.27	2.8
L93-397	16.4	12	5	47	5.58	4.63	2.5
L93-398	13.1	11	6	42	7.29	5.05	2.3
L93-399	13.1	14	7	48	6.53	4.76	3.0
L93-400	11.1	7	2	33	8.32	1.73	2.3
L93-401	17.1	12	4	29	7.06	4.61	2.0
L93-402	13.3	5	2	38	8.35	1.62	1.8
Mean	13.5	10	4	38	7.44	4.06	2.5
$LSD_{0.05}$	1.2	8	5	24	1.53	4.72	1.2

Table 4. Mean plant cane variety reaction to the sugarcane borer among locations in 1995.

Variety	Internodes	Bored internodes	Exited internodes	Pupation success	Stalk number	Moth production	Rating
	stalk^{-1}	----- % internodes -----		%	----------	m^{-2} ---------	unitless
CP70-321	15.8	13	3	24	7.32	3.93	4.2
CP74-383	13.2	28	9	33	8.23	9.54	5.5
LCP82-89	13.5	21	6	30	7.97	6.16	4.0
LCP85-38	15.2	19	6	32	10.60	9.93	4.0
L93-358	15.2	19	5	28	7.50	5.58	3.8
L93-363	14.4	25	8	35	7.51	8.38	4.6
L93-364	14.4	11	2	15	8.08	2.59	2.9
L93-365	13.0	30	9	31	6.68	8.19	5.0
L93-366	13.3	20	4	21	10.66	7.20	4.8
L93-371	15.1	26	6	22	5.97	5.50	4.9
L93-372	14.8	20	5	25	7.38	5.56	3.0
L93-374	14.1	22	6	30	8.47	7.51	4.1
L93-376	13.6	25	7	29	7.51	6.97	4.1
L93-378	13.8	25	6	28	8.34	7.16	4.8
L93-380	15.0	18	5	30	5.95	4.67	4.9
L93-382	15.1	23	9	40	6.32	8.79	5.4
L93-385	14.1	27	9	34	8.10	10.01	5.1
L93-386	14.0	20	8	38	7.37	8.54	4.3
L93-387	13.2	27	7	32	7.12	6.22	5.3
L93-388	14.4	23	6	26	8.06	7.55	4.8
L93-390	13.9	17	4	22	7.69	4.33	4.5
L93-391	17.7	22	6	22	6.11	5.84	4.4
L93-393	16.9	12	3	27	7.79	3.77	3.4
L93-394	12.2	22	6	25	7.71	5.00	4.6
L93-395	16.5	16	4	24	7.97	4.96	3.4
L93-396	14.8	33	14	42	7.41	15.42	5.1
L93-397	17.0	29	9	36	5.84	9.30	4.9
L93-398	13.8	24	11	44	6.78	9.79	5.1
L93-399	15.3	26	9	35	6.70	8.45	4.3
L93-400	12.4	27	7	30	8.76	8.52	4.7
L93-401	19.2	20	5	25	7.36	6.60	3.3
L93-402	14.4	12	3	24	8.48	3.53	3.0
Mean	14.6	22	6	30	7.73	7.09	4.4
$LSD_{0.05}$	1.4	12	5	14	1.60	5.49	1.6

Table 5. Broad-sense genetic variance components, heritabilities and potential response to selection for single plot and replicated selection scenarios for borer resistance components.

Parameter†	Internodes	Bored internodes	Exited internodes	Pupation success‡	Stalk number	Moth production	Rating
	(stalk)$^{-2}$	— (% internodes)^2 —		%^{2}	——— m^{-4} ———		unitless
σ_G^2	2.24**	16.07*	4.33**	32.14*	1.229**	3.742**	0.249
	±0.61	±9.68	±2.00	±15.10	±0.395	±2.103	±0.169
σ_{GL}^2	0.17	49.75**	4.83*	-12.69	0.554*	6.889*	0.888**
	±0.25	±18.44	±3.20	±26.02	±0.342	±3.902	±0.342
σ_E^2	1.59	49.08	15.66	219.09	1.602	17.214	0.980
	±0.15	±4.67	±1.49	±20.84	±0.152	±1.638	±0.093
	stalk^{-1}	—— % internodes ——		%	——— m^{-2} ———		
Mean	14.6	22	6	30	7.727	7.125	4.4
	——— % ———						
GCV	10.3	18.2	34.7	18.9	14.3	27.1	11.3
$H_{1,1}$	56.1	14.0	17.5	13.5	36.3	13.4	11.8
$H_{2,2}$	82.4	30.2	40.6	39.9	64.5	32.6	26.5
$H_{1,4}$	79.9	20.6	33.1	43.3	56.3	25.1	18.0
$GA_{1,1}$	13.5	12.0	25.5	12.2	15.2	17.5	6.8
$GA_{2,2}$	16.4	17.6	38.9	21.0	20.3	27.3	10.3
$GA_{1,4}$	16.1	14.5	35.2	21.9	18.9	23.9	8.5

* Mean squares significant at the $P \leq 0.05$ level.

** Mean squares significant at the $P \leq 0.01$ level.

† σ_G^2 - broad-sense genetic variance; σ_{GL}^2 - genotype by location interaction; σ_E^2 - residual variance; GCV - genetic coefficient of variation = $100\sigma_G$/mean; $H_{1,1}$ - broad-sense heritability for one location and one replication; $H_{2,2}$ - broad-sense heritability for two locations and two replications; $H_{1,4}$ - broad-sense heritability for one location and four replications; $GA_{1,1}$ - genetic advance assuming 10% selection intensity for one location and one replication; $GA_{2,2}$ - genetic advance assuming 10% selection intensity for two locations and two replications; $GA_{1,4}$ - genetic advance assuming 10% selection intensity for one location and four replications.

Table 6. Broad-sense genetic correlations among borer resistance components.

Trait	Internodes	Bored internodes	Exited internodes	Pupation success	Stalk number	Moth production	Rating
Internodes	1.000	-0.373	-0.302	-0.280	-0.267	-0.220	-0.530
Bored internodes	-0.373	1.000	0.925	1.050	-0.251	0.798	0.747
Exited internodes	-0.302	0.925	1.000	1.184	-0.244	0.886	0.734
Pupation success	-0.280	1.050	1.184	1.000	-0.247	1.088	1.175
Stalk number	-0.267	-0.251	-0.244	-0.247	1.000	0.244	-0.309
Moth production	-0.220	0.798	0.886	1.088	0.244	1.000	0.572
Rating	-0.530	0.747	0.734	1.175	-0.309	0.572	1.000

ASSESSMENT OF VARIETAL RESISTANCE TO THE SUGARCANE BORER

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Resistance to Diatraea saccharalis (F) damage (SCB) in sugarcane can be categorized predominately as antibiosis. Physical characteristics of the plant, such as leaf-sheath appression and rapid rind hardness development, contribute to the differential survival of young larvae among cultivars. Also, additional mortality factors in certain cultivars seem to affect survival and development of larger larvae after boring into the stalk. The use of percent bored internodes is a means of ranking sugarcane cultivars on observed external evidence of D. saccharalis tunneling into the stalk. However, the degree of internal damage to the plant and the ultimate survival of D. saccharalis larvae are not addressed with this assessment. Varietal resistance to the latter stages of D. saccharalis injury is a primary goal of the entomology contribution to the LAES breeding program.

The L-93 series (28 cultivars) and four commercial cultivars used as standards (CP 70-321, LCP 82-089, CP 74-383, and LCP 85-384) were planted on September 26,1994, in a four-replicated randomized block design on the Lanaux Plantation, Killona, LA. Two plots of each commercial cultivar and one plot of each L93 cultivar were planted in each replication. On November 15, 1995, a 15 stalk sample was cut from each replicate (4 replications = 60 stalks per 93 cultivar and 2 plots x 4 reps =120 stalks per commercial cultivar). Each sugarcane stalk was examined to determine the number of bored internodes, moth emergence, and the total number of internodes. In this test no insecticides were used for control of the SCB, but granular Lorsban was applied in late June to the soil surface to suppress the fire ants and enhance SCB infestation.

The overall sugarcane borer infestation was heavy with 34% bored internodes as the mean of the experiment. The highest recorded SCB infestation in an active experimental cultivar was 48% bored internodes in L 93-365 with a moth emergence of 51,607 moths per acre. L 93-395 had the lowest percent bored internodes (23%) of the experimental cultivars and had the second to lowest moth emergence of 27,293. No cultivar was below the economic threshold of 10% bored internodes. Prior to the collection of the entomological data, 19 L92 cultivars were dropped from the breeding program.

Table 2 lists the first stubble test of the L-92 series planted on September 23, 1993, in a four-replicated randomized block design on Lanaux Plantation. Granular Lorsban was applied to these experimental plots in the same manner described above. Data on percent bored internodes and moth emergence were collected on six L-92 series and four commercially cultivated varieties (Nov. 15,1995). L 92-307 has the highest percent bored internodes of the experimental cultivars (32%), and a moth emergence of 49,993 per acre which was the highest in the experiment. L 92-315 and L 92-314 had the least percent bored internodes of the experimental cultivar of 14% and 15%, respectively.

Relative to this insect pest in sugarcane, a grower's primary objective is to minimize

economic impact. There are two approaches to reduce the economic impact of pests. The first is to minimize the overall cost incurred in controlling the pest. Use of resistant varieties reduces pest damage at little or no cost to the grower. Resistance rating schemes traditionally have focused on the prevention of damage, whereas our research now provides an additional criteria. Incorporating the cultivar's pest survival rating better allows us to flag varieties which enhance D. saccharalis populations, involves little additional data collection, and enhances the efficiency and value of the entomological component in sugarcane breeding and varietal development of the LSU Agricultural Center.

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Table 1. *Diatraea saccharalis* plant cane damage and survival inside the stalk of four commerci varieties and 1993 L series cultivars during 1995 on the Lanaux Plantation, Killona, LA.

Variety	Internodes per Stalk	----% Internodes---- Bored	Emergence	Percent Survival	Stalks/Acre	Moth/Acr Productio
CP70-321	17.0	19	5	20	32330	23916
L93-364	16.0	19	4	15	32217	18793
L93-402	15.6	19	4	18	34825	22075
L93-395†	18.3	23	5	20	32216	27293
L93-390	15.2	26	5	17	33351	25833
L93-358	16.2	27	6	21	32330	28594
LCP82-89	14.5	27	6	21	34996	26824
L93-401	21.3	28	6	22	30969	34772
L93-380	16.6	28	6	22	26664	26602
L93-386	15.8	31	12	37	27339	51486
L93-366	14.1	31	7	23	52181	49843
L93-391†	18.8	32	7	21	24162	31777
LCP85-384	16.6	32	9	26	43972	60776
L93-385†	14.6	34	7	20	36239	35700
L93-376†	14.4	35	9	22	32103	34470
L93-363†	15.8	35	10	25	28602	41530
L93-371	15.7	36	7	20	24503	25229
L93-372	15.9	36	8	21	32443	37192
L93-374	15.3	36	10	28	30425	45091
L93-382	16.2	38	13	31	28246	56598
L93-394	12.8	38	9	21	34372	35045
L93-398	14.5	38	17	46	25402	59149
L93-399†	17.5	38	10	27	27792	49149
L93-378†	15.5	39	9	23	32455	42262
L93-388	15.6	41	10	25	34712	54208
CP74-383	13.8	43	12	28	34714	55539
L93-397†	17.7	46	14	28	24756	56850
L93-387	13.7	46	10	21	27339	34054
L93-396	15.4	47	19	38	32232	87774
L93-365†	13.7	48	13	25	29154	51607
L93-400	13.7	48	13	28	37406	64507
Mean	15.8	33	9	24	32465	41147
$LSD_{0.05}$	2.07	10.4	5.5	12.3	7728	24959

† Experimental varieties still in active testing during the fall of 1995.

Table 2. *Diatraea saccharalis* first ratoon damage and survival inside the stalk of four commercial and six experimental cultivars from the 1992 L series during 1995 on the Lanaux Plantation, Killona, LA.

Variety	Internodes per Stalk	----% Internodes---- Bored	Emergence	Percent Survival	Moth/Acre Emergence
CP 70-321	16	12	3	21	14217
L 92-315	19	14	2	16	19976
L 92-314	17	15	2	10	9741
L 92-312	18	18	3	14	17500
L 92-319	19	20	3	17	22824
LCP 85-384	16	26	5	21	41759
L 92-321	16	26	3	13	18473
CP 65-357	16	31	6	19	26898
L 92-307	16	32	7	22	49993
CP 74-383	15	33	8	24	42852
MEAN	16.5	22.44	4.31	18.33	26775
$LSD_{0.05}$	1.68	8.39	3.10	10.44	19108

% Survival = the percent of bored internodes that adults emerged from.
Moth Emergence = number of internodes exited times each cultivar's population from the 1995 nursery tests.

INSECTICIDAL CONTROL OF THE SUGARCANE BORER
SMALL-PLOT TEST

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Control of the SCB was evaluated in a randomized complete block design (5 replications) of first stubble variety LCP 85-384 at the St Gabriel Research Station, St Gabriel, LA. Insecticide treatments were applied to 3 row plots over the sugarcane canopy with a CO_2 sprayer mounted on an ATV on 7 July, 28 July, and 25 August. Three 0.005 flat fan spray tips per 6 ft width of row at 35 psi applied 20 gal of finished formulation per acre. Initial treatment was made when the SCB infestation exceeded the economic threshold (5% of the stalks containing live larvae in the leafsheaths); succeeding applications occurred when reinfestations began to appear in the Guthion/Baythroid treatment. Prior to the initiation of the experiment, Lorsban 15G was applied (15 lb/acre) to suppress red imported fire ant predation on SCB larvae (13 June). SCB damage was assessed by counting the bored internodes, exit holes, and total number of internodes from 75 randomly selected stalks of sugarcane (15 stalks/ replication) in each treatment (20 October). All of the Confirm treatments were applied with Triton CS-7 at 0.125% v/v. Following ANOVA, separation of means was by LSD.

Except for the Guthion/Asana combination, all insecticide treatments resulted in less than 10% bored internodes (economic injury level). All treatments were significantly different from the untreated check of 26.8% bored internodes.

Table 1. Small Plot Insecticide Trials of the Sugarcane Borer at the St. Gabriel Research Station, 1995.

Treatment/Form.	Rate lb(AI)/ac	% Bored Internodes	Moth emergence (No./stalk)
Confirm 2F	0.07	1.92a	0.03a
Confirm 70 W	0.07	2.14a	0.04a
Confirm 70 W	0.13	2.18a	0.03a
Asana 40 W	0.033	3.18a	0.11a
Confirm 70 W	0.09	3.41a	0.07a
Asana 40 W	0.05	3.77a	0.04a
Asana XL .66 EC	0.033	4.46a	0.06a
Baythroid 2L	0.033	4.87a	0.14a
Baythroid 2L	0.016 +		
Guthion 2L	0.4	5.02a	0.11a
Karate 1 EC	0.03	5.73a	0.06a
Fury 1.5 EC	0.04	5.98a	0.12a
FCR 4545 1EC	0.016	6.16a	0.13a
Asana XL .66 EC	0.05	6.59a	0.12a
Karate 1 EC	0.025	7.20a	0.16a
Asana 0.66EC	0.016 +		
Guthion 2L	0.4	16.66b	0.42b
Control	—	26.89c	0.56c
P>F(ANOVA)		0.0001	0.0001
LSD(0.05)		5.7551	0.1867

Means followed by same letter do not differ significantly (P=0.05,LSD). Moth emergence from 15 stalks per plot. Application dates 7 July, 28 July, and 25 August.

EVALUATION OF SELECTED INSECTICIDES FOR WEST INDIAN CANEFLY (WIC) CONTROL

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Three different insecticide treatments were used to control WIC on Little Texas Plantation, Napoleonville, LA. Treatments were randomly assigned to plots (ca. 2-3.5 acres each) according to an RCBD with 4 replications. Plots were treated on July 11, when a heavy field-wide infestation of WIC (Avg = 18 per third leaf below the whorl on July 10) was producing copious amounts of honeydew on which sooty mold was beginning to develop. Treatments were applied using an AG Cat flying swaths of 54 ft delivering 2 gallons per acre finished formulation. On July 14th, 18th, and 26th the total numbers of WIC on the third leaf down from the first visible dewlap of 20 to 30 plants were recorded. In addition, yellow sugarcane aphids (YSA) were counted on July 18th and 26th similarly as described above.

The results of this test are present in table 1. Three days after treatment on July 14, methyl parathion treated plots had significantly fewer WIC (ca. 99.9% control) than the other treatments. Numbers of WIC in Baythroid and Provado treated plots were not significantly different from each other but were significantly less than the untreated plots. Seven days posttreatment (July 18), control of WIC resulting from Provado increased to a level not significantly different from methyl parathion. Baythroid was significantly less effective against WIC than Provado or methyl parathion but Baythroid treated plots did have fewer WIC than untreated plots. Baythroid treated plots had significantly more YSA than other treatments including the untreated plots. Fifteen days posttreatment (July 26), all insecticide treatments resulted in significantly fewer WIC than observed in untreated plots.

Table 1. Mean number of insects per leaf.

Treatment/Form.	Rate lb (AI)/ acre	July 14 WIC	July 18 WIC	July 18 YSA	July 26 WIC	July 26 YSA
methyl parathion 4EC	0.5	0.03a	0.62a	0.25a	4.55a	0.05a
Provado 1.6F	0.025	8.99b	1.56a	1.10ab	6.08a	1.51a
Baythroid 2L	0.033	9.43b	4.84b	6.43c	6.49a	8.64b
Untreated		32.01c	19.16c	3.25b	12.48b	5.86b
P>F (ANOVA)		0.0001	0.0001	0.0001	0.0001	0.0001
LSD (0.05)		3.92	2.17	2.19	3.41	3.54

Means followed by the same letter do not differ significantly (P=0.05).

PATHOLOGY RESEARCH

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STALK ROT RESEARCH

Breeding for resistance:

Previous research on this project determined that resistance to red rot exhibits only low to moderate heritability, and that single year evaluations of resistance are unreliable. The best strategy for breeding for resistance is to focus effort on identifying resistant parents and using them in appropriate crosses. However, it was determined that resistance is rare in the current breeding population. Therefore, the basic germplasm collection was screened during 1995 in cooperation with Dr. D. Burner, USDA/ARS Sugarcane Research Unit, to identify new sources of resistance.

Stalks of 225 clones were inoculated with the pathogen, held under controlled conditions for six weeks, split, then evaluated for the extent of red rot development. Twenty clones (9%) were rated as resistant, 22 (10%) were rated as moderately resistant, 83 (37%) were rated as intermediate, 61 (27%) were susceptible, and 39 (17)% were highly susceptible. This experiment will be repeated during 1996.

Factors affecting disease severity:

Field and laboratory experiments confirmed that drought stress can result in severe damage from red rot in the commercial varieties. Previous experiments and a field experiment conducted during 1995 demonstrated that stress associated with poor drainage (waterlogging) also can result in severe disease. However, waterlogging did not occur where the stalks were located in the row, suggesting that the increase in stalk rot was due to some effect on the root system. Therefore, metalaxyl, a fungicide to control root rot, was added as a treatment in the 1995 experiment, using CP 65-357, CP 72-370, and LCP 82-89. In addition, experiments were conducted in the greenhouse with the same varieties to determine the interaction between red rot and root rot affecting bud germination and shoot growth.

In the field experiment, treatment with metalaxyl eliminated the stand reduction that occurred in plots with poor drainage that were planted with stalks inoculated with the red rot pathogen. The results suggest that root rot was the cause of the stress that led to red rot and stand reductions. In the greenhouse experiments, inoculation with the red rot pathogen alone did not result in reductions in germination and shoot growth. Reductions were observed only for red rot inoculated stalks when inoculum of the root rot pathogen was added to the soil. These results demonstrate that plant cane stand problems are associated with an interaction between two diseases, red rot and root rot, and environmental stress.

Billet planting studies:

During 1995, the first results were obtained from field experiments comparing varieties planted as machine-cut billets or whole stalks. Two adjacent fields were planted with three varieties, CP 70-321, LCP 82-89, and CP 85-800. Shoot population counts were taken during fall and spring, and actual yields were obtained during December.

Shoot counts were lower in billet planted rows of CP 70-321 in both fields and rows of LCP 82-89 in one field. Shoot populations were similar in rows of CP 85-800 planted as billets or whole stalks. Tons of cane per acre and pounds of sugar per acre were lower in billet planted CP 70-321 in one field, and sugar per ton was lower in the second field. Sugar per acre was lower in billet planted LCP 82-89 in one field. Yields were the same for CP 85-800 planted as billets or whole stalks. The results suggest that some varieties tolerate billet planting better than others. CP 70-321 was the least tolerant variety. It is uncertain whether the observed yield reductions would be offset by the savings associated with billet planting. Yields will be determined in first stubble to see if the lower yields in billet planted rows persist.

During fall 1995, experiments were planted at two locations comparing planting with billets or whole stalks for two varieties, CP 70-321 and LCP 85-384. In addition, different fungicides were applied to determine if stands obtained from billet planting can be improved by chemical control of stalk rot. Three broad-spectrum fungicides, benomyl, captan, and mancozeb; the root rot fungicide, metalaxyl; a fungicide formulation containing mancozeb and metalaxyl, and a promising experimental fungicide were applied at planting at one location. An organic amendment was substituted for captan at the second location. Spring stands and plant cane yields will be obtained during 1996.

ROOT DISEASE RESEARCH

Pythium root rot studies:

Research continued to determine the potential of soil amendment with various organic wastes to suppress Pythium root rot. Wastes that were suppressive or nonsuppressive to disease could be distinguished on the basis of differences in biological and chemical properties. In addition, wastes that were suppressive when added to soil only in nonsterile form could be distinguished from wastes that suppressed root rot when added in sterile or nonsterile form. High microbial activity was a good indicator of the potential of a waste to suppress root rot. The highest microbial activity levels and highest populations of prokaryotic organisms were present in the wastes that were suppressive when added in nonsterile form, such as sewage sludge and sugar mill filterpress cake. These wastes also had the highest nitrogen levels, lower C:N ratios, and variable high levels of mineral nutrients, including P, K, Mg, and Mn. Bark composts that were suppressive when added to soil even after steam treatment contained high levels of Ca and S and had high C:N ratios. Municipal solid and yard waste composts that were not suppressive to root rot had the lowest microbial activity levels of all the wastes, but varied in their chemical properties. Solid waste compost had high nutrient levels and the highest content of salts and Na. Yard waste compost had lower levels of C and N.

Two field experiments were conducted with different methods and timing of application

of sewage sludge. Approximately two tons of sludge (dry weight) was applied per acre to LHo 83-153 plant cane and CP 65-357 first stubble fields of sugarcane. Plant cane stalk population and yields of tons of cane per acre and sucrose per acre were increased when sludge was applied to open planting furrows, but not to closed rows after planting. A spring (early May) application also did not result in increased yield. A May application to first stubble did not result in yield increases. Yields will be compared in each field again during Fall 1996.

Nematode studies:

Cooperative research was conducted with Dr. E. C. McGawley and J. P. Bond concerning the effects of nematodes on different sugarcane varieties and possible control measures. A summary of research results is included separately in the annual report.

RATOON STUNTING DISEASE RESEARCH

Cooperative research was conducted with Dr. K. E. Damann (LAES) and Dr. Mike Grisham (USDA/ARS Sugarcane Research Unit) to determine and compare rates of spread of RSD in the current commercial varieties. Two types of experiments were conducted at each of two locations: the St. Gabriel Branch Experiment Station of the Louisiana State University Agricultural Center and the Chacahoula Research Farm of the USDA/ARS Sugarcane Research Unit. Eight varieties, CP 65-357, CP 70-321, CP 72-370, CP 79-318, LHo 83-153, LCP 82-89, LCP 85-384, and HoCP 85-845, were included in the St. Gabriel experiments, and the same varieties plus LCP 86-454 were included in the Chacahoula experiments. Each variety was planted during fall 1994 in three, single-row plots with an RSD-infected "spreader" plot preceding every plot. The plant cane was harvested during October 1994. Stalks were collected from each plot in sequential order and planted. During Fall 1995, stalks were collected in sequential order at harvest from the first stubble and plant cane plots of each variety and assayed for the presence of RSD, using five different assays. The first stubble results provide an estimate of the rates of spread and increase of RSD in the varieties within fields from one season to the next. The plant cane results provide an estimate of the rates of spread and increase of disease between fields for comparison. The sensitivity and accuracy of the different disease detection assays also could be compared.

Differences were detected in rates of RSD spread and increase between experiments and locations. Rates of disease spread and increase were higher for the experiments at St. Gabriel than at Chacahoula. At each location, the rates of RSD spread and increase were higher in the between-field spread test than in the within-field spread test. Differences also were detected in the rates of RSD spread and increase among varieties. The lowest rates of disease spread and increase occurred in CP 72-370 and LCP 85-384, and the highest rates occurred in LCP 82-89. The results of the assay comparisons are incomplete at this time.

The analysis of the 1995 results will be completed during 1996. In addition, the second stubble of the within field spread experiments at both locations will be sampled during fall, 1996. The rates of spread and increase of RSD after two harvests will be determined and compared in the different varieties.

LEAF SCALD RESEARCH

Additional surveys were conducted to monitor the distribution and extent of occurrence of leaf scald caused by *Xanthomonas albilineans*. The disease was detected at new locations, and it is apparent that leaf scald is widespread in the Louisiana sugarcane industry. The highest levels of disease continued to be observed in CP 74-383, LCP 82-89, and HoCP 85-845. Two additional yield loss experiments were conducted in fields of LCP 82-89 naturally infected with leaf scald. Yield was adversely affected by the disease in one of the two fields. A possible new greenhouse method for evaluation of resistance levels for experimental varieties in the variety selection program found differences among varieties that match field observations. This experiment was conducted by S. Lopes in cooperation with Dr. K. E. Damann. A summary of the results is included separately in the annual report.

MOSAIC RESEARCH

Naturally occurring mosaic infection levels were monitored in varieties and experimental varieties planted in yield trials on farms (outfield tests) to evaluate levels of resistance to infection by sugarcane mosaic virus. The results are shown in Table 1. Susceptible commercial varieties include: CP 65-357, CP 72-370, LCP 82-89, and LCP 86-454. The experimental varieties appear to be resistant, with the possible exception of CP 88-739.

SMUT RESEARCH

Resistance levels to smut caused by *Ustilago scitaminea* were determined in an inoculated test for experimental varieties in the selection program. The results are shown in Table 2. Three (60%), one (20%), and one (20%) of the 1988 and 1989 series clones were resistant, moderately susceptible, and highly susceptible, respectively, to smut, Four (44%), three (33%), and two (22%) of the 1990 and 1991 series clones were resistant, moderately susceptible, and highly susceptible. Six (66%) and three (33%) of the 1992 series clones were resistant and moderately susceptible, and 10 (32%), 11 (34%), and 10 (32%) of the 1993 series clones were resistant, moderately susceptible, and highly susceptible to smut.

Table 1. Sugarcane mosaic infection levels and resistance ratings in commercial and experimental varieties determined from natural infection occurring in yield trials on farms (outfield tests)

Variety	Percent infection	Rating [a]	Experimental variety	Percent infection	Rating [a]
CP 65-357	71.3	8	CP 88-739	8.2	1
CP 70-321	3.6	1	L 89-113	0.1	1
CP 72-370	39.9	4	HoCP 89-843	0.1	1
CP 74-383	5.6	1	HoCP 90-923	5.3	1
LCP 82-89	11.4	2	HoCP 90-941	2.3	1
LHo 83-153	0.3	1	HoCP 90-957	2.0	1
LCP 85-384	0.2	1	HoCP 90-963	0.1	1
HoCP 85-845	2.6	1	HoCP 90-977	0.1	1
LCP 86-454	31.0	4	L 91-250	0.1	1
			L 91-281	0.1	1
			HoCP 91-552	0.0	1

[a] Resistance ratings assigned on a 1-9 scale, in which 1-3 = resistant, 4-6 = moderately susceptible, and 7-9 = highly susceptible.

Table 2. Smut infection levels and resistance ratings determined from the 1995 inoculated test

Variety	Infection(%)	Rating[a]	Variety	Infection(%)	Rating[a]
CP 65-357	5.9	3	L 93-363	3.0	2
CP 70-321	0.0	1	L 93-364	6.3	3
CP 73-351	46.8	8	L 93-365	45.3	8
CP 74-383	40.6	8	L 93-366	15.7	4
CP 81-335	21.4	5	L 93-371	6.7	3
CP 85-500	13.7	4	L 93-372	43.3	8
HoCP 88-739	5.9	3	L 93-373	0.0	1
L 89-113	1.2	2	L 93-374	18.3	5
HoCP 89-843	18.4	5	L 93-376	27.9	6
HoCP 89-846	39.7	7	L 93-378	12.7	4
Ho 89-889	4.7	3	L 93-380	7.2	3
HoCP 90-923	33.3	7	L 93-382	44.8	8
HoCP 90-941	0.0	1	L 93-385	14.6	4
HoCP 90-957	1.2	2	L 93-386	41.6	8
HoCP 90-963	6.7	3	L 93-387	0.0	1
HoCP 90-977	32.9	7	L 93-388	52.8	9
L 91-250	7.1	3	L 93-389	31.0	6
L 91-281	26.4	6	L 93-390	43.4	8
L 91-288	22.2	5	L 93-391	16.1	5
L 91-290	30.0	6	L 93-932	14.3	4
LHo 92-307	5.8	3	L 93-393	39.1	7
L 92-310	2.8	2	L 93-394	36.3	7
L 92-312	3.7	2	L 93-395	20.1	5
L 92-313	10.6	4	L 93-396	7.9	3
LHo 92-314	7.2	3	L 93-397	2.9	2
L 92-315	0.0	1	L 93-398	8.5	4
L 92-319	25.8	6	L 93-399	3.6	2
L 92-321	7.1	3	L 93-400	20.3	5
L 92-355	16.9	5	L 93-401	35.0	7
L 93-358	33.6	7	L 93-402	4.2	3

[a] Resistance ratings assigned on a 1-9 scale, in which 1-3=resistant, 4-6=moderately susceptible, and 7-9=highly susceptible.

NEMATOLOGY RESEARCH

E.C. McGawley, J.W. Hoy, C. Overstreet, J.P. Bond, R.G. Miller, and S.R. Erwin
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Nematodes are microscopic worm-like animals that damage sugarcane plants by feeding on and killing root cells. This damage results in reduced rates of growth and subsequent yield losses which can be as high as 50%-60%. To date, over 200 species of nematodes have been reported from the major sugarcane-producing regions of the world. In Louisiana, however, very little research has been conducted with nematodes and sugarcane over the last 20 years, and none has been done by a trained nematologist. During the last two years, we conducted a survey of nematode genera and species associated with current sugarcane varieties, completed a series of greenhouse and microplot studies, and initiated nematicide trials at several locations. These preliminary studies have been conducted to determine whether or not nematodes are significant biological constraints in the current sugarcane production system.

Survey work revealed the occurrence of a wide spectrum of nematode species in the genera *Trichodorus* (stubby-root nematode), *Tylenchorhynchus* (stunt nematode), *Criconemella* (ring nematode), *Pratylenchus* (lesion nematode), *Helicotylenchus* (spiral nematode), and *Meloidogyne* (root-knot nematode). Additionally, a comparison of nematode population densities in plant and ratoon cane showed a significant population buildup over time. Samples collected from ratoon cane routinely had 3-4 times more nematodes per pint of soil than did those from plant cane. The multiple-year cropping practice employed for cultivation of sugarcane provides living root tissue in the soil year round and favors the development of large communities of nematodes comprised of multiple species. Also, virtually all of the nematodes found associated with sugarcane also reproduce on a wide variety of weed species, especially Johnsongrass, which are common in sugarcane fields. Weed occurrence, therefore, provides an additional means for nematodes to bridge the winter months or fallow periods when only minimal sugarcane root growth occurs.

Greenhouse studies were conducted using five popular sugarcane varieties (CP 65-357, CP 70-321, LCP 82-89, HoCP 85-845, and LCP 86-454) and nematodes isolated from sugarcane during the 1994 growing season. After 110 days, the growth of all nematode inoculated varieties (4X level = 4000 nematodes per pot) was reduced significantly when compared with a non-inoculated control (Table 1). Plant weight reductions at the conclusion of the experiment ranged from 31% with CP 70-321 to 60% with HoCP 85-845. All varieties supported abundant nematode reproduction (Table 2) with the nematodes generally reproducing to a greater extent from the 1X than the 4X infestation level. This is likely due to a reduction in the quality of the root system as a substrate for nematode feeding. This experiment was reestablished in December of 1995 and data are now being collected with results which are nearly identical. A third greenhouse experiment, designed to evaluate the impact of nematodes and *Pythium* spp. alone and together on the LCP 82-89, was also initiated in December of 1995 and will run through the end of March 1996.

A 1995 study conducted in microplots, an experimental setup which closely mimics field conditions but permits prescription manipulation of soil microorganisms, also showed dramatic nematode effects on the growth of one of the newer sugarcane varieties, LCP 82-89 (Table 3). There was a 25% reduction in plant weight in the presence of nematodes at the 1X (1200 nematodes per pot) level. This reduction in growth (Figure 1 Left = inoculated with nematodes; right = noninoculated control) was accompanied by a concomitant 285-fold increase in nematode population density (Table 4). CP 70-321, which was also used in this test, supported abundant nematode reproduction but there was no significant damage, suggesting this variety may have some degree of tolerance to nematodes.

Nematicide tests were established in the fall of 1995 at two locations, a site with a heavy soil in Iberville Parish and one with a light soil in St. James Parish. We are evaluating sugarcane yield response and nematode control with the nematicides Temik and Mocap and the insecticide Thimet, which may have some nematicidal activity. Stalk counts were made in December of 1995 and there was a significant increase in stalk numbers in response to Temik application at the St. James location.

Our plans for the remainder of 1996 include the following:

1. Survey activities will be continued and expanded in order to develop a more accurate portrait of current nematode distribution, population levels, and community composition within the major sugarcane-producing parishes of Louisiana.
2. Greenhouse studies such as those described above will continue and be expanded to evaluate pathogenicity of individual nematode species.
3. Disease interaction experiments with nematodes and *Pythium* spp. will be conducted in field microplots. Selective fungicides and nematicides will be used to compare the relative effects of the nematodes and root rot fungi in soils collected from selected sugarcane fields with histories of unsatisfactory yield performance.
4. Three types of field studies will be conducted: a disease nursery will be established at the St. Gabriel Research Station to compare nematode resistance in current and potentially new sugarcane varieties; a study of the ability of soil amendments with sewage sludge, and possibly other organic wastes, to suppress soilborne pathogens and increase yields; and nematicide trials established in 1995 will be continued.

The goal of this research is to develop disease management practices that will allow growers to reduce soilborne disease and thereby increase sugarcane yields. It is imperative that we have a current evaluation of the magnitude of the damage being caused by plant parasitic nematodes. The initial benefit of this project will be a vastly improved understanding of the impact of nematodes and their interaction with root rot fungi on sugarcane varieties produced in Louisiana. Although this project is obviously a multiple year study, at the same time basic studies are being conducted, possible control measures will be developed. We believe that research conducted over the last two years shows that nematodes are limiting factors in sugarcane production. Data collected clearly provide sufficient justification for support by the American Sugar Cane League for further research.

Table 1. Growth of five popular sugarcane varieties as influenced by inoculation with nematodes isolated from Louisiana sugarcane fields, 1995.

Variety/ Infestation Level	Plant Ht. (cm)	Top Visible Dewlap (cm)	Top Dry Wt. (g)	Root Dry Wt. (g)
CP 65-357				
0X	170.0 a	48.0 a	36.3 a	44.2 a
1X	164.1 b*	42.6 ab	33.9 ab	23.7 b*
4X	157.9 b*	40.3 b*	24.7 b*	22.8 b*
CP 70-321				
0X	163.3 a	41.7 a	32.5 a	41.7 a
1X	142.9 ab	35.2 ab	25.3 ab	25.2 b*
4X	128.0 b*	28.8 b*	20.7 b**	25.7 b*
LCP 82-89				
0X	144.1 a	36.1 a	31.8 a	40.7 a
1X	134.0 ab	31.5 ab	24.6 b*	18.6 b*
4X	122.3 b*	29.4 b*	19.1 b**	14.0 b**
HoCP 85-845				
0X	152.7 a	46.0 a	35.9 a	65.6 a
1X	126.7 b*	37.6 ab	25.3 b*	15.5 b**
4X	123.6 b*	35.3 b*	20.7 b*	20.3 b*
LCP 86-454				
0X	170.1 a	51.0 a	41.1 a	33.8 a
1X	151.1 ab	47.7 ab	31.7 ab	15.6 b**
4X	137.3 b*	42.5 a	24.4 b**	18.5 b**

Within columns, numbers followed by common letters do not differ at $\underline{P} \leq 0.05$ according to Tukey's HSD test. * and ** indicate differences significant at $\underline{P} \leq 0.05$ and $\underline{P} \leq 0.01$, respectively.

Table 2. Reproduction of various nematode genera on five popular sugarcane varieties, 1995.

Variety/ Infestation Level	Stubby		Stunt		Ring		Total	
	Pf[a]	R[b]	Pf	R	Pf	R	Pf	R
CP 65-357								
1X	58.5 a	248	19.2 a	292	28.3 a	57	106.1 a	106
4X	37.2 a	40	11.4 b	44	28.4 a	14	77.1 a	19
CP 70-321								
1X	28.6 a	121	13.4 a	203	26.5 a	53	68.6 a	68
4X	20.7 a	22	7.2 b	27	18.1 a	9	46.0 b	11
LCP 82-89								
1X	39.2 a	166	17.2 a	261	12.4 a	25	68.9 a	68
4X	29.5 a	32	8.4 b	33	13.1 a	7	51.0 a	13
HoCP 85-845								
1X	28.1 a	119	23.0 a	349	8.8 b	17	60.0 a	60
4X	17.0 b	18	10.7 b	42	36.2 a	18	64.0 a	16
LCP 86-454								
1X	34.7 a	147	22.2 a	336	15.9 a	32	72.9 a	72
4X	25.5 a	27	9.8 b	38	17.4 a	8	53.8 a	13

[a] Pf=final population in thousands.

[b] R=reproduction value obtained by dividing Pf by the number contained in original inoculum. Within columns, numbers followed by the same letter do not differ at $P \leq 0.05$ according to Tukey's HSD test.

Table 3. 1996 microplot study of nematode effects on growth of the sugarcane varieties CP 70-321 and LCP 82-89.

Variety/ Infestation Level	Plant Ht. (cm)	Top Visible Dewlap (cm)	Top Dry Wt. (g)	Root Dry Wt. (g)
CP 70-321				
0X	234.0 a	92.2 a	298.9 a	201.7 a
1X	226.3 a	84.8 a	327.1 a	219.5 a
4X	230.5 a	85.1 a	325.6 a	212.9 a
LCP 82-89				
0X	245.2 a	99.5 a	411.3 a	302.5 a
1X	219.4 b	81.3 b	298.2 b	217.0 b
4X	223.0 b	84.4 ab	320.5 ab	220.0 ab

Within columns, numbers followed by common letters do not differ at $P \leq 0.05$ according to Tukey's HSD test.

Table 4. Nematode reproduction on sugarcane varieties used in the 1996 microplot study.

Variety/ Infestation Level	Stubby		Stunt		Ring		Total	
	Pf[a]	R[b]	Pf	R	Pf	R	Pf	R
CP 70-321								
1X	3.2 a	6	187.6 a	499	6.0 a	16	197.0 a	157
4X	3.9 a	0.8	213.7 a	57	19.3 b	5	237.0 a	19
LCP 82-89								
1X	6.5 a	13	314.4 a	836	37.5 a	98	358.9 a	285
4X	7.5 a	1.5	292.9 a	78	12.4 a	3.2	312.8 b	25

[a] Pf=final population in thousands.

[b] R=reproduction value obtained by dividing Pf by the number contained in original inoculum. Within columns, numbers followed by the same letter do not differ at $P \leq 0.05$ according to Tukey's HSD test.

NEMAS
NO NEMAS
LCP 82-89

WEED CONTROL RESEARCH IN SUGARCANE

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In 1995, experimental and labeled herbicides were evaluated for sugarcane tolerance and control of Italian ryegrass (*Lolium multiflorum* Lam.), johnsongrass (*Sorghum halepense* (L.) Pers.), bermudagrass (*Cynodon dactylon* (L.) Pers.), itchgrass (*Rottboellia cochinchinensis* (Lour.) W. Clayton), purple nutsedge (*Cyperus rotundus* L.), and red morningglory (*Ipomoea coccinea* L.). The project personnel are appreciative of funding from the American Sugar Cane League and cooperation of Mike Melancon, Ronnie Roberts, Boo Levert, and Alfred Guidry (St. Martin Parish); Steve and Chuck Loupe and Miles Brashier (Pointe Coupee Parish); Ed Richard (Terrebonne Parish); Puddy Gautreaux and Bill Davis (Ascension Parish); Jerry Woods, Arthur Schexnayder, and Jimmy Garrett (St. James Parish); and Robert Morris, Mike Andre, and Harry Laws (West Baton Rouge Parish). Below is a summary of research results.

Ryegrass Research

In 1995, a state label was granted for use of Gramoxone Extra prior to sugarcane emergence in spring. Research was conducted to evaluate atrazine (1.5 qt/A), Karmex/Direx (3.6 lb product/A), and Gramoxone Extra (1.0, 1.5, and 2.0 pt/A) applied in mid-February or mid-March alone and in mixtures. For the February application, ryegrass control 28 days after treatment was 83% for Gramoxone Extra at 2.0 pt/A plus atrazine or Karmex, which was greater than when Gramoxone Extra was applied alone at 2.0 pt/A (66%) or at lower rates alone or in tank mixtures (44% to 68%). Control 56 days after the February application was equivalent (74% to 80%) for the 2.0 pt/A rate of Gramoxone Extra alone or in combination with Karmex or atrazine. Control 28 days after the March application was significantly greater for the Gramoxone Extra treatments (86% to 88%) than for Sinbar, Sencor, atrazine, or Karmex applied alone (30% to 38%). Although differences in ryegrass control were noted, they were not reflected in increased sugarcane shoot population, stalk height, or yield. Benefits from removing ryegrass, which include faster drying of fields, improved tillage, earlier cane emergence, better placement of soil-applied herbicides, and increased fertilizer efficiency, may more than justify the cost of the Gramoxone Extra treatment.

In another study, Gramoxone Extra was applied when sugarcane was actively growing on March 21 and April 7. Sugarcane injury 28 days after the March application was slightly greater with Gramoxone Extra at 2.0 pt/A (23%) than with 1.0 pt/A (16%) or Karmex at 2.4 lb product/A (15%). Sugarcane shoot population and height in August and cane yield each was equivalent for the Gramoxone Extra and Karmex treatments. This indicates that even though cane was injured with Gramoxone Extra, recovery was rapid and complete.

Asulox Return on Investment Study

The objective of this study was to determine the effect of Asulox application on johnsongrass

control, sugarcane fiber content, and sugar recovery. Asulox (4 qt/A broadcast rate) treatment dates were (1.) April 29, (2.) May 19, (3.) April 29 followed by June 17, and (4.) June 17. A no Asulox treatment was included for comparison. Johnsongrass control 4 weeks after Asulox treatment was 79% (April application), 51% (May application), 85% (April followed by June application), and 41% (June application). Cane stalk population in August was greater than the nontreated check only when Asulox was applied in April or in April and June. Stalk population following Asulox applied only in June was equal to the nontreated check. Cane height in August was similar regardless of timing of Asulox application, and was no greater than the nontreated check. Sugarcane was not harvested in this study. In other studies, results have shown that presence of johnsongrass at harvest following an Asulox application is not a good indicator of the effectiveness of the treatment. Application of Asulox in April, May, or April followed by June compared with no Asulox significantly reduced fiber in cane delivered to the mill and increased sugar recovery. Application was beneficial whether or not sugarcane was burned. Considering the cost of the Asulox treatment and the enhanced sugar yield associated with the application, return on investment from an April application was $183 per acre.

Johnsongrass Research

Johnsongrass Control in Succession Planted Sugarcane. In a study conducted at St. Gabriel, sugarcane was harvested in early October and within one week, the old cane rows were tilled, opened, and planted. Johnsongrass control prior to the May Asulox application was at least 88% when Oust was applied at 2 or 3 oz/A after planting, and the sequential spring application of Prowl plus atrazine or Sencor did not further enhance control. For all Oust treatments, johnsongrass control prior to Asulox application was greater than when only Sencor (31%) or Sinbar (35%) was applied after planting. Johnsongrass panicle counts in August were significantly reduced when Asulox was applied following Oust at 1 and 2 oz/A. Sugarcane stalk population in August was greater for all Oust treatments than when Sencor was followed by Asulox. Additionally, sugarcane stalk population for Oust applied at 3 oz/A was higher than when Sinbar was followed by Asulox. For individual Oust rates, sugar yield was equal regardless of sequential treatment used. In most cases, sugar yield for the Oust treatments was no higher than when Sinbar was followed by Asulox.

Johnsongrass Control With Roundup Under Simulated Rainfall. Studies were conducted July 20 and August 10, 1995, to evaluate rainfastness of Roundup D-Pak and spray additives in respect to rhizome johnsongrass control. Plots received either no rainfall or rainfall 15 or 60 minutes after herbicide application using a rainfall simulator delivering 0.5 inch of water in 15 minutes. Herbicide treatments included Roundup D-Pak at 30 oz/A with Kinetic HV at 0.25% (v/v), Break-Thru at 0.15% (v/v), or Induce at 1.0%.

In the first study, johnsongrass was 12 to 40 inches tall and in the vegetative stage when Roundup was applied. With no washoff, johnsongrass control seven and 14 days after treatment with Roundup D-Pak was at least 80% and 90%, respectively, with all additives being equal. For both the 15- and 60-minute washoff times, control was greater with the addition of the organosilicone additive Break-Thru than Induce or Kinetic HV. After the two-week control rating, plots were mowed and regrowth was visually rated four weeks later. Averaged across

additives, johnsongrass regrowth was greater for the 15-minute washoff timing (28%) than for the 60-minute timing (14%) or the no washoff (15%) treatment. Averaged across washoff timings, johnsongrass regrowth was no greater than 19% for the additives, which was equal and less than the nontreated check (39%).

In the second study, johnsongrass was 48 to 60 inches tall with 20% to 30% of panicles emerged when Roundup was applied. With no washoff, johnsongrass control seven and 14 days after treatment with Roundup D-Pak was at least 76% and 86%, respectively, with all additives being equal. For both the 15- and 60-minute washoff timings, control was greater with the addition of Break-Thru than Induce or Kinetic HV. Averaged across additives, johnsongrass regrowth was similar for the 15 (20%) and 60 (21%) minute washoff timings, which was greater than for the no washoff (5%). Averaged across washoff timings, johnsongrass regrowth was equal for all additives and less than the nontreated check.

Johnsongrass Control With Roundup D-Pak and Additives. Field studies were conducted to evaluate effectiveness of various additives with Roundup D-Pak at 20 oz product/A for rhizome johnsongrass control. In the first study, johnsongrass was 20 to 36 inches tall and in the vegetative stage when herbicide treatments were applied. Johnsongrass control seven days after treatment was 36% with the addition of HM 9207A to Roundup D-Pak. This was equal to when Penetrator Plus was added (34%), but greater than for the other additives. Control 14 days after treatment was equivalent for the organosilicone additives Herbex (43%), Break-Thru (41%), Silwet L-77 (35%), Silwet 408 (40%), and the Induce standard (40%). At both seven and 14 days after treatment, addition of 2,4-D to Roundup D-Pak plus Induce did not reduce control over that observed with only the addition of Induce. After the two-week control rating, plots were mowed and regrowth was visually rated four weeks later. Johnsongrass regrowth was 89% for the nontreated check, but no more than 11% for the Roundup D-Pak treatments.

In the second study, johnsongrass was 15 to 53 inches tall with 15% to 30% of panicles emerged when Roundup treatments were applied. At seven days after treatment, Roundup D-Pak with the addition of the organosilicone adjuvants Break-Thru (36%), Silwet L-77 (36%), or Silwet 408 (35%) controlled more johnsongrass than with addition of Induce (23%). These same responses were also noted 14 days after treatment. Johnsongrass regrowth following application of Roundup D-Pak plus Induce (33%) was equal to all other treatments including the nontreated check (55%).

Bermudagrass Research

Bermudagrass Control With Gramoxone in Spring. This study was conducted to determine the possible benefit of Gramoxone Extra application in spring for desiccation of bermudagrass. Gramoxone Extra applied alone at 2.0 pt/A or at 1.0 or 2.0 pt/A in combination with the standards Sencor, Sinbar, or Prowl plus atrazine injured sugarcane more than that observed with the standards applied alone. Addition of Gramoxone Extra, however, increased bermudagrass control over that of the standards, but control 28 days after treatment was still no more than 64%. Gramoxone Extra applied alone at 2.0 pt/A or in combination with the standards was equally effective in controlling bermudagrass. Even though bermudagrass control was enhanced

with the addition of Gramoxone Extra, sugarcane stalk population and height in August were no higher than when only the standard herbicides were applied.

Bermudagrass Control With Authority and Command in Spring. Sugarcane injury for the Authority and Command combinations ranged from 28% to 35% (16 days after treatment) and 11 to 16% (28 days after treatment). Injury was significantly greater than that observed for Authority applied alone or in combination with Prowl and for the Sinbar and Prowl plus atrazine standards. Greater bermudagrass control 16 days after treatment was observed for the Authority and Command combinations (75% to 81%) than for Authority alone or in combination with Prowl (0 to 6%). Bermudagrass control 28 days after treatment for the Authority and Command combinations, although greater than the other treatments, was no more than 43%. Although differences in bermudagrass control and sugarcane injury were observed, sugarcane stalk population and height in August for all treatments were no greater than for the nontreated check.

Roundup and Tillage Fallow Bermudagrass Programs. Bermudagrass control was greater when Roundup was combined with tillage than when only tillage was used. Control obtained during the fallow period was negated if atrazine (after planting) and Prowl plus atrazine (spring) was applied rather than Sinbar (after planting) and Lexone (spring). In August, sugarcane stalk populations and stalk heights were similar regardless of herbicide treatment.

Bermudagrass Control With Gramoxone Applied After Layby. Gramoxone Extra was applied postemergence-directed after layby using a single flood tip nozzle to treat the entire row. In three studies, bermudagrass was controlled 84% to 93% with Gramoxone Extra at 1 pt/A and 93% to 95% with 2 pt/A. In comparison, atrazine and Direx controlled bermudagrass no more than 28% and 50%, respectively. Even though differences in weed control were noted, sugarcane stalk population and height in August were equivalent regardless of herbicide treatment. Effective control of bermudagrass after layby may reduce the potential transport of bermudagrass in seed cane to clean fields and in harvested cane delivered to the mill.

Bermudagrass Control With Roundup Under the Hooded Sprayer. Roundup 4L was applied at 1, 2, and 3 qt/A under a hooded sprayer on October 20 to cane that had been harvested for seed. Bermudagrass control around 6 weeks after treatment for the high rate was 91%, which was greater than for the lower rates. Plots will be observed in spring to determine the long-term effects of the treatments.

Itchgrass Research

Selected herbicide treatments were applied to weed-free sugarcane rows in August to evaluate itchgrass control. Control 18 days after treatment was at least 90% with Visor at rates of 0.38 lb/A or higher. Control was equal to that observed with Prowl plus atrazine (2.0 + 2.0 lb/A and 3.0 + 2.0 lb/A), Authority alone (0.375 and 0.50 lb/A), or Command plus Authority (1.0 + 0.375 lb/A and 1.0 + 0.50 lb/A). Itchgrass control 39 days after treatment with the highest rate of Prowl plus atrazine was 98%, which was equal to that for Authority alone or in combination with Command, and for Visor at 1.0 lb/A plus atrazine. Visor applied at the lower rates controlled itchgrass 71% to 89%.

Purple Nutsedge Research

Purple nutsedge control 14 days after treatment was greatest and at least 69% for Sempra at 0.036 and 0.063 lb/A and Authority at 0.50 lb/A. All herbicide treatments provided greater control than atrazine. At that time slightly greater sugarcane injury was observed following application of Authority (10% to 11%) compared with Sempra and atrazine (1%). Purple nutsedge control 28 days following application of Sempra at the low (74%) and high (81%) rates was significantly greater than for all other treatments. Although differences in purple nutsedge control were noted, sugarcane stalk population and height in August were equivalent for all herbicide treatments and the nontreated check, indicating that purple nutsedge was not highly competitive with sugarcane.

Red Morningglory Research

In studies conducted at two locations, none of the standard herbicides (Sinbar, Sencor, Direx, or atrazine) applied preemergence at layby controlled red morningglory more than 74% approximately 30 days after treatment. Atrazine, which is most commonly used, controlled red morningglory 31% to 69%. In other studies, preemergence application of Authority provided 96% red morningglory control compared with only 33% for atrazine. Authority was also applied postemergence after layby when morningglory was vining. In that study, Authority at 0.38 lb/A controlled red morningglory 98% compared with 85% for atrazine at 2 qt/A.

Sugarcane Tolerance to After Planting Herbicide Treatments

To evaluate sugarcane tolerance, Oust was applied at 2 oz product/A 42 days prior to planting and immediately after planting of CP 70-321, CP 72-370, LCP 82-89, LCP 85-384, and LCP 86-454 in September. Prowl plus atrazine (3.0 + 2.0 lb/A) and Sencor (1.8 lb/A) were also applied after planting. For each cultivar, with the exception of LCP 85-384, sugarcane stalk population in August was equal regardless of the herbicide treatment applied. For LCP 85-384, stalk population was equivalent when Oust, Prowl plus atrazine, or Sencor was applied at planting and greater than when Oust was applied 42 days before planting. When herbicides were applied at planting, sugarcane stalk population for LCP 85-384 was greater than for the other cultivars. Within each cultivar sugar yields were equivalent regardless of herbicide treatment.

PERSISTENCE AND LEACHING OF ALGINATE-CONTROLLED RELEASE FORMULATIONS (CRFs) OF ATRAZINE AND METRIBUZIN IN SOILS GROWN TO SUGARCANE

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Controlled release formulations are considered successful when applied under field conditions by maintaining the herbicide concentration in the soil solution somewhat above a critical level required for effective control of weeds or insects. A literature search revealed that limited data are available on the influence of CRFs on herbicide persistence. Recent studies reported an increase in persistence when the herbicides were applied as starch encapsulated CRFs. This was attributed to a decrease in availability of the herbicide to soil microbes. An increase in alachlor persistence was noted with starch CRFs. We are not aware of efforts to quantify the mobility and persistence of CRFs in soils.

Objectives:

The overall objective of this project is to evaluate the efficacy and environmental fate of a new weed control system for sugarcane based on granular alginate controlled release formulations of atrazine and metribuzin in comparison to commercial systems of the same herbicides. The specific areas to be addressed are encompassed in the following individual objectives:

1. The efficacy of a weed control system for sugarcane based on CRFs of atrazine and metribuzin will be compared to commercial systems of the same herbicides in field experiments.

2. The persistence and leaching potential of alginate CRFs of atrazine and metribuzin will be compared to commercial formulations of the same herbicides in field experiments.

Methods:

Sugarcane variety CP70-321 was planted on October 11 and 12, 1993, on two soils, a Sharkey and a Commerce at the St. Gabriel Research Station Each plot was approximately two-thirds of an acre (72 ft by 400 ft) and was fallow since harvest in November 1992. No chemicals were applied following planting until fertilization with 120 lb/acre of (UAN, 32% nitrogen, 50:50 urea:ammonium nitrate) which was injected into the soil May 5, 1994. On May 6, 1995, KCl at a rate of 120 lb/acre was applied as a tracer solute to monitor the mobility of applied formulation under field conditions. Alachlor and metribuzin as CRFs were applied in triplicated randomized block design (three reps and four treatments) at two rates of 1 and 2 lb/acre of active ingredients. A control plot (no herbicides added) and a commercial formulation at the rate of 2 lb/acre were also applied. Soil samples were collected one day prior to CRF application (May 11, 1994) for background herbicide levels. To follow the mobility and concentration levels of CRFs, sampling of both soil types was performed in the 0-6 and 6-12 inch depths on May 23-24, June 8-9, July 11, and September 29. An additional sampling at 12-18 inchs was collected on the last sampling date. All soil samples have been extracted and analyzed (using GC) for the various herbicides in our laboratory and will be reported in the

quarterly report. Plant cane was harvested and subsamples were taken for complete sugar analysis (percent solids). Yields were significantly higher for Commerce soil than for Sharkey soil. No significant differences of sugar yields (tons per acre) were observed among all treatments for Commerce soil whereas a significantly higher yield was obtained for the commercial formulation for Sharkey soil. This finding was anticipated and consistent with our observations of extensive weed pressures in the clay Sharkey soil in comparison to the Commerce silt loam. Atrazine formulation was recently applied as a winter herbicide on Jan 10, 1995, and will be followed with depth throughout the winter/spring.

Results and Discussion:

On December 6, 1994, atrazine herbicide formulations were applied to two soils; Sharkey clay and Commerce silt loam at St. Gabriel Research Station, St. Gabriel, LA. Each plot consisted of a randomized block design with three block replications and four treatment levels. The treatments were: commercial atrazine at 2.24 kg/ha, controlled release formulations (2% linseed oil) at 2.24 kg/ha and 1.12 kg/ha, and control - no herbicide. Soil samples were taken in triplicate from each treatment at two depths (0-6 and 6-12 inches) on January 31 and March 10, 1995. A third depth (12-18 inches) was additionally sampled on April 8. Weed control estimates were taken on April 19. On May 2, the plots were band fertilized with 120 lb/ac KCl, and treated with asulam to control seedling johnsongrass (Commerce plot - 1.33 lb a.i./ac, Sharkey plot - 2.33 lb a.i./ac). Liquid nitrogen fertilizer (UAN 32% N) was band incorporated at 120 lb/ac on May 23. On May 24, new treatments of metribuzin herbicide were applied to all plots. The treatments were: commercial metribuzin at 2.24 kg/ha, controlled release formulations (0% and 1% linseed oil) at 2.24 kg/ha, and control - no herbicide. Soil samples were taken in triplicate from each treatment at two depths (0-6 and 6-12 inches) on June 22 and July 6, 1995. A third depth (12-18 inches) was additionally sampled on August 17, 1995. Weed control estimates were taken on July 12 and August 12, 1995. Collected soil samples were stored at 4° C until extracted. With the exception of 144 samples, all soils have been extracted and analyzed by gas chromatography. Sugarcane stalk counts per treatment were taken on September 26 and all plots were harvested on November 13. 1995. Sugar yield (lbs sugar/ac) significantly differed (α=0.05) between soils, with the Commerce soil averaging 2081 lbs sugar/ac more than Sharkey soil. Significant differences were observed between the two soil types. However, no significant differences in yield were observed between treatments for each soil.

Table 1. 1994 Sugarcane Yield Data for different control release formualtions.

Soil	Treatment	Stalks/acre (×1000)	Yield (tons/acre)	Total Solids (BRIX %)	Sucrose (%)	SugarYield (lbs/acre)
Commerce						
	CR Low	26.5	39.4	15.7	13.2	7319[a]
	CR High	26.2	40.5	16.2	13.8	7937[a]
	Commercial	26.6	39.0	16.5	14.1	7839[a]
	Control	27.0	42.5	15.9	13.5	8120[a]
Sharkey						
	CR Low	21.9	29.2	15.5	13.3	5476[b,c]
	CR High	21.5	27.0	15.5	13.1	4985[c]
	Commercial	27.0	33.6	16.2	13.9	6627[b]
	Control	21.5	26.3	15.7	13.5	5002[c]

Means with same superscript are not significantly different ($p > 0.05$).

Table 2. 1995 Sugarcane Yield Data for different control release formualtions.

Soil	Treatment	Stalks/acre (×1000)	Yield (tons/acre)	Total Solids (BRIX %)	Sucrose (%)	SugarYield (lbs/acre)
Commerce						
	CR 1% Oil	36.6	47.6	18.1	13.1	8742[a]
	CR 0% Oil	35.9	43.3	19.1	14.3	8901[a]
	Commercial	34.0	43.0	19.0	14.3	8780[a]
	Control	33.7	41.8	18.9	14.2	8481[a]
Sharkey						
	CR 1% Oil	34.0	41.3	17.5	12.7	7339[b]
	CR 0% Oil	33.5	35.5	17.4	12.7	6305[b]
	Commercial	34.3	37.5	17.9	13.0	6901[b]
	Control	30.8	34.0	17.7	12.7	6037[b]

Means with same superscript are not significantly different ($p > 0.05$).

SUGARCANE DEMONSTRATION PROJECT; NUTRIENT AND PESTICIDE MANAGEMENT STRATEGIES

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INTRODUCTION

The goal of this demonstration project is to provide the necessary data to quantify water quality benefits and effectiveness of best management practices (BMPs) on reducing nonpoint source pollutants from fertilizer, herbicide, and insecticide applications on sugarcane fields. Such a data base along with results on the leaching losses of these chemicals in surface and subsurface waters will constitute the basis for implementation of cultural practices by sugarcane growers to minimize water contamination. The specific objectives were:

1. To quantify the leaching losses of fertilizers (N, P, and K), herbicides (atrazine and metribuzin), and insecticides (azinphosmethyl) in surface runoff water and subsurface ground water on sugarcane fields under conventionally accepted cultural practices of sugarcane farming in alluvial soils of southern Louisiana.

2. To determine the effect of different rates of chemical applications for sugarcane on their losses in surface runoff waters.

3. To make quantifiable estimates on the surface and ground water quality benefits of the management practices utilized for sugarcane.

MATERIALS AND METHODS

The site chosen is at the St. Gabriel Research Station of the Louisiana State University Agricultural Center. The site is approximately 3.5 acres and the soil was classified as a Commerce silt loam (Aeric Fluvaquent, fine-silty, mixed, nonacid, thermic). During summer 1992, the land was rowed and prepared for six foot rows where six plots (two replications x three treatments) running east to west were outlined with levees surrounding each treatment. Each plot was 375 ft in length and was approximately one-half acre. The sugarcane variety CP 70-321, which is a major variety for southern Louisiana, was chosen and planting was completed in September 1992. At the lowest part (north-east corner) of each plot, we installed sumps (corrugated, galvanized culverts, 36 inches in diameter and 6 1/2 feet in depth). In each sump,

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a water pump connected to a flow meter was installed. Adjacent to each sump, we placed an automated water sampler and connected the sampler tubing and sensors to each sump by placing the sampler cup and sensor at the bottom of each sump. Sample collection was triggered when runoff water was detected by a float in the water pump.

The amounts and/or number of applications of applied agricultural chemicals used in this study were above and below that which is recommended for use as the accepted cultural practice for sugarcane in southern Louisiana. Specifically, our three treatments were conventional or standard treatment, high treatment, and low treatment as described below:

Herbicides: Metribuzin was applied as a pre-emergence herbicide and atrazine as a winter application for weed control following harvest. Both metribuzin and atrazine were applied as a broadcast for the high treatment, banded with 36-inch band-width for the standard treatment and 24-inch band-width for the low treatment. We maintained the intensity of herbicide application (amount per area of coverage) constant for all three treatments. As a result, for the 36-inch band-width applications, one-half the amount of herbicides received on an acre basis compared to the broadcast application. For the 24-inch band-width (treatment 3), only 1/3 of the amount of herbicides in the broadcast treatment was applied. Actual amounts applied for atrazine were 2, 1, and 0.66 quarts/acre and for metribuzin were 1.8, 0.9 and 0.6 lb/acre for the high, standard, and low treatments, respectively. In addition, asulam was applied as a broadcast in late spring or early summer as a post-emergence herbicide.

Insecticides: The insecticide azinphosmethyl is commonly used in southern Louisiana during June-August. The number of broadcast applications of azinphosmethyl (1.5 quarts/acre) during the summer is dependent on the extent of sugarcane borers. In this study, the number of applications varied from a single application for the low treatment to three applications for the high treatment. The timings of applications were mid-July, mid-August, and mid-September. The mid-August application was received by all treatments.

Fertilizers: The standard or conventional treatment received the recommended amounts of N-P-K of 120-40-80 lb/acre as N-P_2O_5-K_2O, whereas the high treatment received 180-80-120, and the low treatment received 60-0-0 lb/acre. Fertilizer application was banded each spring for all treatments.

Harvesting: One-row mechanical harvester was used for sugarcane harvest during late October or early November. Sugarcane yields were obtained from weights of 100 ft length of three cane rows. For each plot, yields (tons/acre) based on an average of two 100 ft weights were reported. Counts of the number of stalks per acre were performed prior to harvest. Ten-stalk subsamples were taken from each plot for complete sugar analysis and calculation of sugar/acre.

Winter cover: After the third year, following cane harvest of second stubble, one treatment will remain fallow until planted with soybeans in the spring of the fourth year. In another treatment, the plots will remain fallow until next fall when planted with a new sugarcane crop. In the third treatment, the plots will be planted to winter wheat after harvest in October or early November.

RESULTS AND DISCUSSION

Table 1 provides the amounts of fertilizer and pesticides applied during 1993 and 1994. In addition Tables 2 and 3 provide the amounts of chemicals losses in runoff water, expressed in terms of pounds per acre, for fertilizers and pesticides, respectively. Losses are also expressed as percent of the amount applied.

Atrazine: Atrazine (2-chloro-4-ethylamino-6-isopropylamino-s-triazine), which has been used for over 30 years, is one of the most widely applied herbicides in the world today. Atrazine has been detected in groundwater samples collected from agricultural lands. Though atrazine concentration levels in the groundwater tend to be low, its long persistence suggests that it reaches the water table, and is for that reason subject to accumulation in groundwater (Johnson et al. 1995). The lifetime health advisory level for atrazine in drinking water is 3 ppb. In 1994, the amounts of atrazine losses in runoff waters were extremely small. These amounts represent some 10% loss of that applied for each treatment. Moreover, rainfall distribution patterns and timing of application did not influence the amount susceptible for runoff among treatments. Atrazine concentration levels in the runoff ranged from 600-700 ppb measured 6 days following applications. For the standard treatment, only half the total area of the field received atrazine. As a result the concentration level was drastically reduced to a range of 120 - 140 ppb. Some three months following applications, the amount detected in the surface water was in the 20-30 ppb range. Amounts of extractable atrazine in the soil surface also decreased rapidly with time. Maximum concentration occurred 3-4 days following application for all three treatments. Lowest concentrations in the soil were observed for the low treatment whereas maximum concentrations were observed for the high treatment. These results on atrazine clearly illustrate the importance of method of application or placement of applied agricultural chemicals. Values of 3000-5000 ppb were observed for the high treatment compared to 1000-2000 for the low treatment. The continued decrease of extractable atrazine from the soil is indicated by the sharp decrease with time to levels below 50 ppb within 90 days following application. This decrease is due to surface runoff, downward movement into the soil to deeper depths, and biodegradation. Persistent levels of as much as 95 ppb were observed some 182 days following applications. Moreover, the resulting concentrations in the runoff water are directly influenced not only by the amount but also the area of coverage.

Metribuzin: Metribuzin (sencor) is a commonly used herbicide throughout the world. It is characterized by its high solubility (1200 mg per liter), moderate half life (40 days), and low affinity or adsorption capacity to the soil (K_{oc} of 60). The lifetime health advisory level for metribuzin in drinking water is 200 parts per billion (ppb) (Wauchope et al., 1992). In this study, metribuzin was applied on March 29, 1993, and March 18, 1994, as a pre-emergence herbicide. Application of this chemical was carried out according to the scheme outlined earlier in the project. Unlike 1993 when rainfall occurred one day following metribuzin application, during 1994 season, some two weeks of no rainfall followed the March 18, 1994, metribuzin application. Although no runoff was collected immediately after application during 1993, we sampled the soil surface frequently in order to assess the amount of herbicide residual in the soil. Installation of all samplers was not completed prior to the 1993 metribuzin application. Metribuzin concentrations in runoff waters after March 27 and April 4 rainfalls (0.6 and 1.0 inches, respectively) were negligible. Significant concentrations were observed in runoff waters

following rainfall on April 12 and 15. The concentration of metribuzin following these rains ranged from 10 to 20 ppb. After June 1, metribuzin concentrations decreased some two months after metribuzin application to levels below 1 ppb.

Azinphosmethyl: This insecticide is commonly known as Guthion and is one of the few labeled insecticides for sugarcane borer control that has not resulted in increased resistance, neither in the laboratory nor field populations. Azinphosmethyl is characterized by its low solubility (29 mg per liter) and a short half-life (10 days). The current integrated insect management practice for sugarcane averages about two annual insecticide applications. This number varies for different fields; therefore the potential for contaminating surrounding aquatic habitat via surface runoff still exists (Smith et al. 1983, Willis et al., 1994, Southwick et al., 1995). Due to the limited rainfall amounts during 1993, no azinphosmethyl runoff losses were found. In 1994, the amounts of losses in runoff waters were extremely small. Actual amounts were 0.0007, 0.0011, and 0 pounds per acre (0.778, 1.247, and 0 grams per hectare) for the high, standard, and low treatments, respectively. These amounts represent a maximum loss of less than 0.1% of that applied. Moreover, rainfall distribution following application influences the amount susceptible for runoff losses. Observed azinphosmethyl concentrations in runoff waters have been quite low (maximum 2 ppb), given that rainfall occurred several days after spraying. It has been established that the decrease in azinphosmethyl concentration on leaf surfaces strongly depends on rainfall patterns: in the absence of a rain, this concentration stabilizes at the levels 0.2 to 0.6 $\mu g/cm^2$ while a rainfall reduces this concentration at least tenfold. Azinphosmethyl concentration in the surface soil also depends strongly on the rainfall history.

Fertilizers: The amounts of nitrogen runoff losses were directly influenced by the amount of fertilizer N application. These N losses ranged from 7.7 to 13 lb/acre for the low and high treatments, respectively. Maximum NO_3-N concentrations in the runoff were highest in June following rainfall and did not exceed 20 ppm. In contrast, no treatment effects were observed for P and K losses. The fact that a large pool of P and K was bound by the soil matrix in various forms (exchangeable, nonexchangeable, bound in the organic residue, adsorbed) resulted in little effect on their leaching losses among the three treatments as shown in Table 2.

Cane Yield: Cane harvest was carried out on October 18, 1995. Subsamples were taken for complete sugar analysis. Table 4 provides the results from 1995 (second stubble) for all three treatments. Although no significant statistical differences were found among the three treatments with regard to all measured parameters, sugar yields (pounds per acre) were highest for the standard treatment. As expected, the standard and high treatments resulted in higher yields than the low treatment. This finding is consistent with our 1994 yield data. In addition, yield for the second stubble was considerably lower than that for the first stubble. We conclude based on these results that the standard treatment provided highest yields with optimum fertilizer utilization and lowest pesticides amounts needed. The standard fertilizer application (120-40-80 pounds per acre of N-P_2O_5-K_2O) used in this study reflects the recommended cultural practice for sugarcane in south Louisiana.

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Table 1. Amount of pesticide and fertilizer chemicals applied annually during 1993-1995.

Treatment	herbicides				insecticide		fertilizer
	atrazine		metribuzin		azinphosmethyl		$N-P_2O_5-K_2O$
	rate	band	rate	band	rate	BC*	
	lb/acre	inches	lb/acre	inches	lb/acre		lb/acre
Low	0.66	24	0.6	24	0.75	1$	60- 0- 0
Standard	1.00	36	0.9	36	0.75	2	120-40-80
High	2.00	BC*	1.8	BC*	0.75	3	180-80-120

* BC=broadcast application
$ number of applications

Table 2. Amount of losses of fertilizer nutrients in runoff water (1994).

Treatment	fertilizer nutrient					
	N		P		K	
	lb/acre	% loss	lb/acre	% loss	lb/acre	% loss
Low	7.7	11.8	0.59	---	6.15	---
Standard	10.5	8.7	0.49	5.6	8.8	26.5
High	13.0	7.2	0.59	3.3	8.6	12.9

Table 3. Amount of losses of pesticides in runoff water during 1993-1994.

Treatment	herbicides				insecticide	
	atrazine		metribuzin		azinphosmethyl	
	lb/acre	% loss	lb/acre	% loss	lb/acre	% loss
Low	0.05	7.6	0.002	0.33	0.0	0.0
Standard	0.08	8.0	0.003	0.33	0.0001	0.01
High	0.22	11.0	0.005	0.28	0.0006	0.08

Table 4. Effect of applied chemicals of the low, standard and high treatments on the second stubble cane yield of CP 70-321 on Commerce silt loam soil on the St. Gabriel Research Station, 1995.

TREATMENT	Replicate Number	PLOT Number	Number of Stalk per acre	Cane Yield tons/ acre	Total solids (BRIX) %	Sucrose %	Sugar Yield lbs/ acre
Low	1	3	29,400	27.0	15.3	12.9	4874
	2	5	26,300	25.6	15.3	13.0	4650
	Average		27,900	26.3	15.3	12.9	4762
Standard	1	1	27,100	28.0	15.5	13.2	5211
	2	6	24,600	28.6	16.0	13.7	5560
	Average		25,950	28.3	15.7	13.5	5386
High	1	2	29,700	27.9	16.3	14.4	5744
	2	4	29,300	28.4	14.9	12.4	4911
	Average		29,500	28.1	15.6	13.4	5328
LSD .05			NS	NS	NS	NS	NS

EVALUATION OF CONSERVATION CROPPING SEQUENCES WITH SUGARCANE
(First Stubble Crop Response)

Howard P. Viator
Iberia Research Station

Summary:

An evaluation of practices designed to produce sugarcane with reduced tillage and augmented ground cover was initiated in the summer of 1993. The objective was to measure the influence on sugarcane of these conservation practices. Fallow-period comparisons were: a conventional fallow utilizing only tillage; a fallow period utilizing herbicides and no tillage; and green manure soybeans. Additionally, post-planting comparisons superimposed on the fallow-period treatments were off-barring vs. no off-barring and winter legume vs. no winter legume.

First stubble sugar and cane yields produced after a conventional fallow period were significantly higher than yields following green manure soybeans grown during the fallow period. Plots yields for the other treatments were intermediate. It appears the allelopathic effects of decomposing soybean residue on stands of plantcane carried over to the first stubble crop. Also, the infestations of bermudagrass, nutsedge, and broadleaf signalgrass were appreciably greater for plots with winter legume plantings on the shoulders of the rows. Unlike the plantcane crop, off-barring decreased the yield of cane which had legumes planted on the row shoulders.

Introduction:

Sugarcane culture does not readily lend itself to tillage and cover crop systems designed to reduce soil erosion. Unfortunately, numerous sugarcane fields in the state possess the soil type and topography conducive to significant soil loss from erosion. Soil removed from such sites may carry unacceptable levels of pesticides and fertilizer, which serve to contaminate water supplies. Approaches to control or minimize soil loss include reducing tillage and/or enhancing ground cover during the fallow period and the growing cycle. Most conservation tillage systems require a minimum of 30% ground cover after planting. Sugarcane culture is in compliance for most of the growing season, but may benefit from reduced tillage or the presence of cover crops at certain times and under certain conditions.

Research was supported by the American Sugar Cane League.

Experimental Procedures:

A field experiment was initiated in the summer of 1993 on a Baldwin silty clay loam with an average organic matter content of 1.92 %.

Three fallow-period treatments followed by sugarcane were compared. A conventionally-tilled fallow, a fallow utilizing only glyphosate and no tillage, and green manure soybeans without tillage or post-emergence herbicides were the fallow-period treatments. Plot size was three rows, each 50 ft in length. Precipitation amounts were excessive in June and July 1993, preventing expeditious tillage of conventional fallow plots. Two passes with row-choppers were accomplished in the conventional fallow plots, one in late May and then not again until the third week of July. On the glyphosate-only plots, glyphosate was applied in mid-July at the rate 2 qt/acre mixed with .25% non-ionic surfactant. Pioneer brand 9592 (maturity group V) soybeans were planted on May 18, 1993, by using two drills spaced 20 in apart on conventional sugarcane rows. A preemergence application of 2 pt of Dual and 2/3 lb of Lexone per acre was used only for the soybean plots. Soybeans were shredded and incorporated in the row on September 7, 1993.

All rows in the experimental area were capped off and rebuilt, and LCP 85-89 was planted on September 9, 1993. A preemergence application of Lexone was sprayed on a 30-in band at the rate of 1 lb/acre.

"Serena" burr medic clover was drilled on the shoulder of rows in all plots planted to soybeans and to half of the glyphosate plots on October 7, 1993. The clover was seeded at 30 lb/acre using appropriate inoculum. Weedmaster, at the rate of 1 qt/acre, was sprayed on February 20, 1994, to desiccate the clover.

On March 8, 1994, the superimposition of the off-barring treatment was accomplished on half of all plots. All plots received recommended rates of fertilizer and herbicides. Layby tillage was accomplished on all plots.

Plantcane was harvested and weighed on November 12, 1994, using a tractor-mounted weigh rig.

After the plantcane was harvested, "Serena" burr medic clover was planted in the same manner and on the same plots as in the previous year. Unlike the plantcane year, the clover was not sprayed with herbicide for desiccation prior to off-barring.

Tillage was conventional for off-barred plots, but utilized only after fertilization and at layby for the plots not off-barred. First stubble plots were harvested on November 1, 1995, with a tractor-mounted weigh rig.

Table 1 - Description of eight conservation tillage treatments

Type of fallow	Herbicides	Off-barring	Winter legume
Conventional	None	Yes	No
Conventional	None	No	No
Chemical	Glyphosate	Yes	No
Chemical	Glyphosate	No	No
Soybean	Pre-emergence	Yes	Yes
Soybean	Pre-emergence	No	Yes
Chemical	Glyphosate	Yes	Yes
Chemical	Glyphosate	No	Yes

A randomized complete-block design was used to evaluate treatment response. Analyses of variance were conducted for the variables cane and sugar yields and their components.

Results:

The first stubble crop response was somewhat different than the plantcane response to conservation practices. As depicted in figure 1, once again the lowest yielding sugarcane was that which followed the fallow period occupied by soybeans grown for green manure. The presence of winter legumes on row shoulders also significantly depressed sugar yield, especially where the undesiccated legume was off-barred (fig 2). The response to the presence and subsequent incorporation of winter legume was unremarkable in plantcane.

Approximately mid-June of 1995, a weed coverage rating revealed appreciably more weeds existing in plots on which soybeans were planted during the fallow period and plots which had winter legume plantings (fig 3). Control measures were not taken to eliminate the weeds (primarily bermudagrass) on the row shoulders where the clover was established, but row tops were sprayed with herbicide to control weeds in cane stubble. Furthermore, off-barred and non off-barred plots averaged 2.7 and 3.3, respectively, in weed coverage rating.

Though premature to conclude that the conservation practices employed affect agronomic performance negatively, there does appear to be a trend toward reduced yields when departing from conventional fallow-period management and/or conventional cultural practices. Conservation practices, as practiced in this experiment, tended by first stubble to either numerically or statistically reduce yields of cane and sugar, juice quality, and stalk population.

Fig. 1 - First stubble sugar yield of cane following the conservation tillage treatments

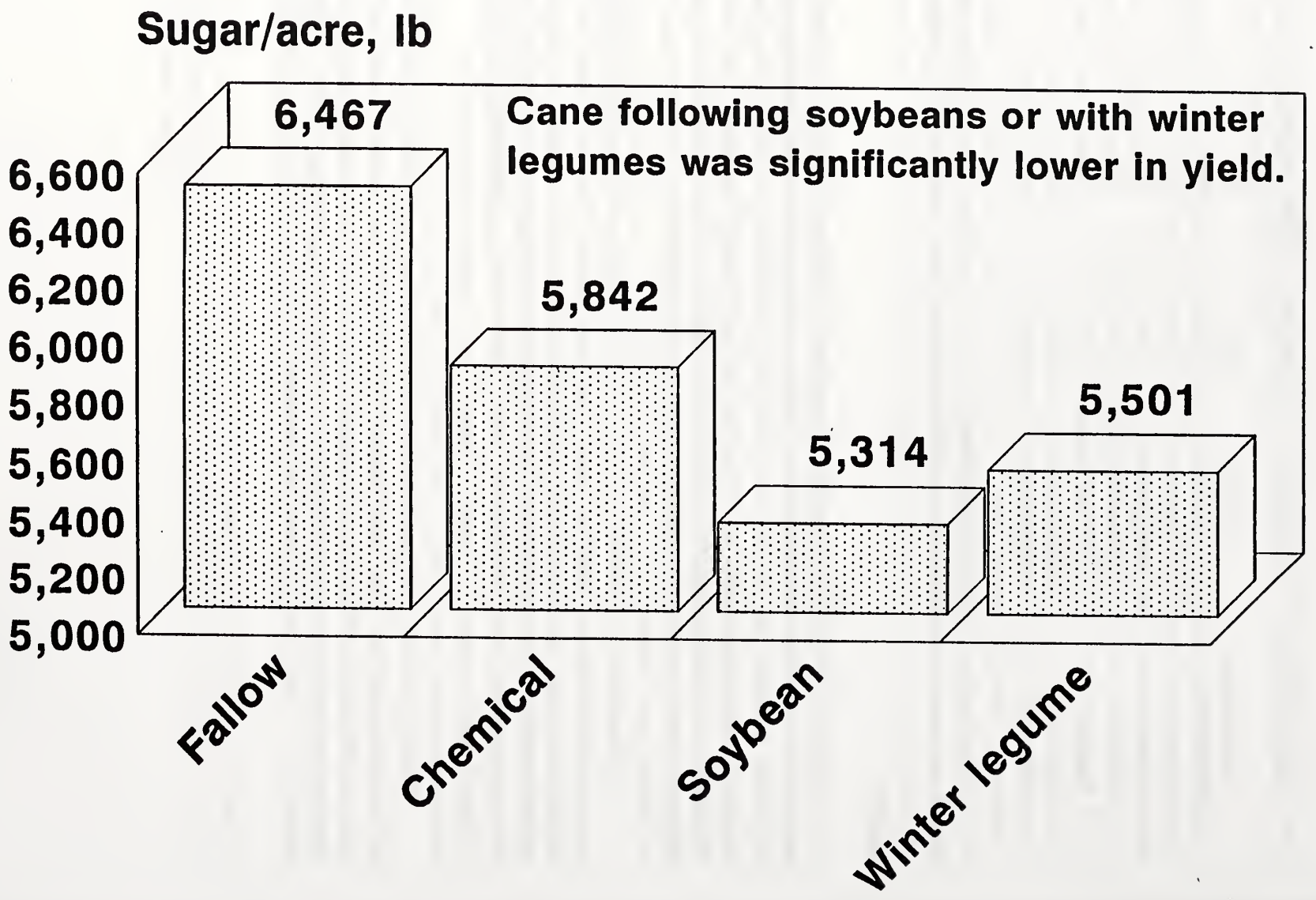


Fig. 2 - The influence of winter legume and off-barring on the yield of sugar.

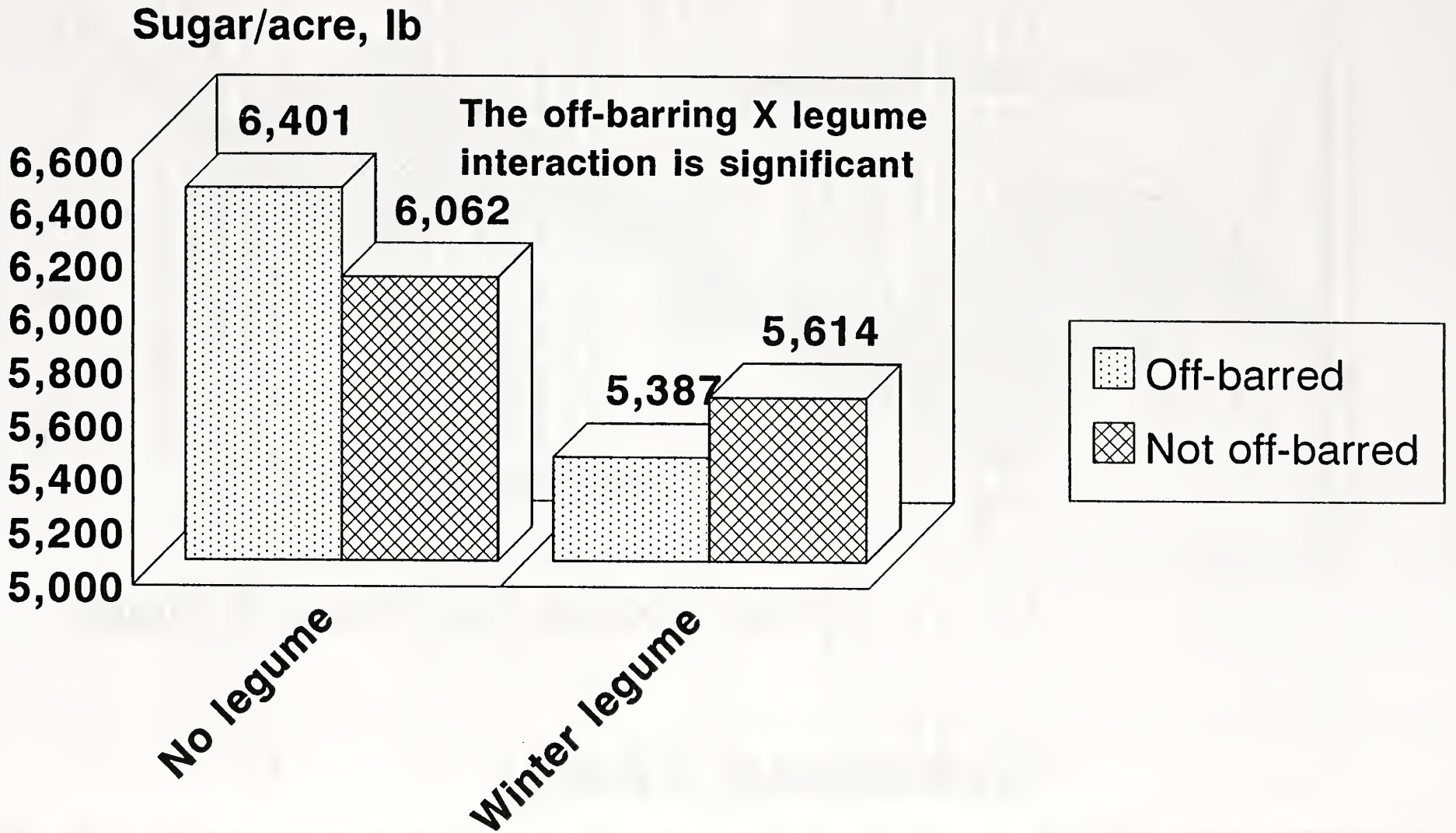
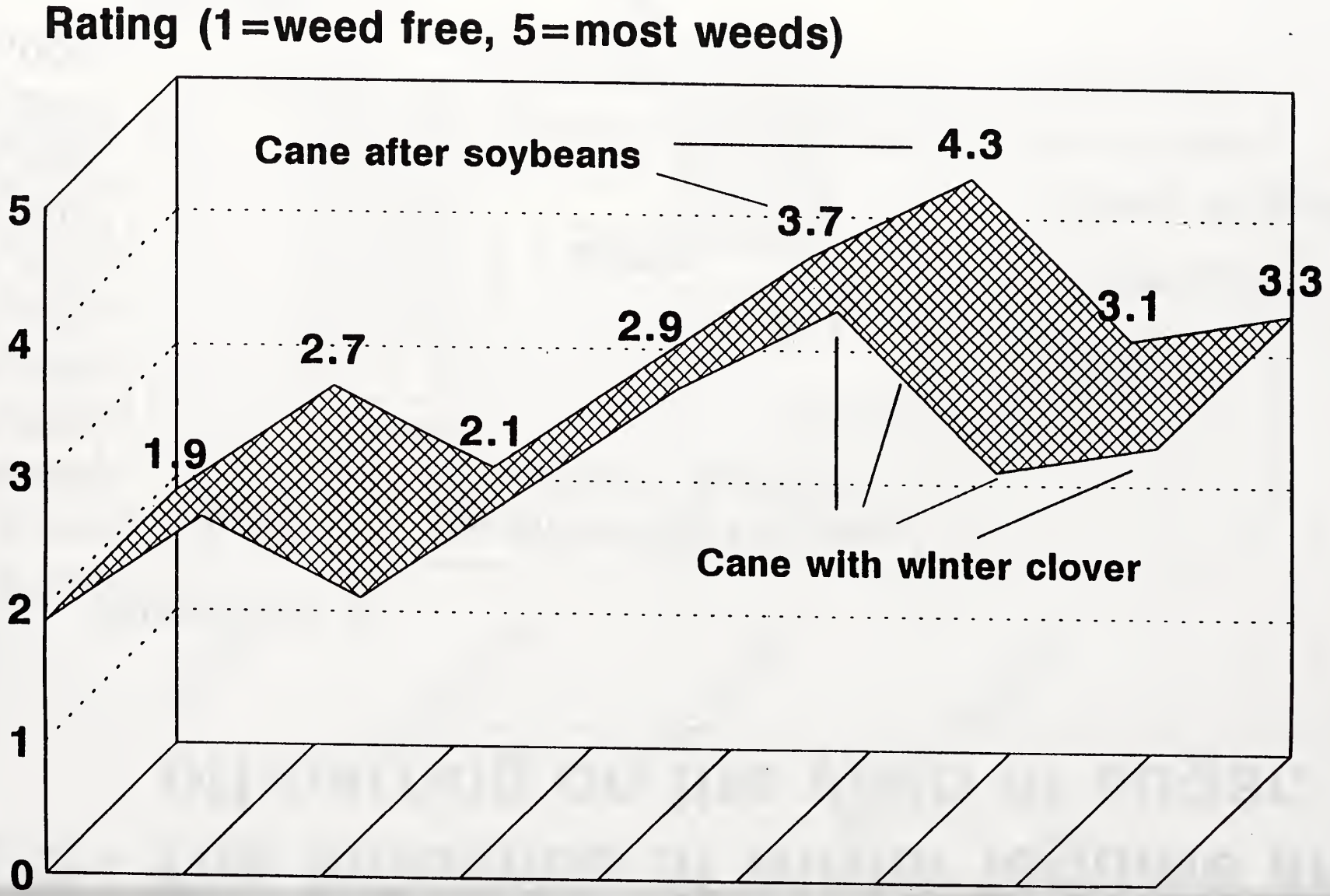


Fig. 3 - Infestation of Weeds for the Conservation Tillage Treatments



CULTURAL AND LAND MANAGEMENT PRACTICE RESEARCH IN SUGARCANE IN 1995

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SUMMARY:

Nine field experiments were conducted in 1995 to test the effects of various cultural and land management practices on the yield components of sugarcane. The newer cane varieties released from the breeding programs at LSU and Houma were included in the experiments. Results from tests on planting practices showed that the average plant cane yields from planting in September and October were similar, but lower than from planting in August and November and the yields were higher from planting a 4-stalk than a 2- and 3- stalk rate of planting. The mean effects of dates and rates of planting in first stubble cane were small. A test on covering seedcane with 3-4, 5-6 and 7-8 inches of packed soil applied at planting time showed that the first stubble yields increased with increasing seed cover depths.

Harvesting experiments showed that plant cane sugar yields of four varieties increased 38.3% during October and 11.6% during November due to a large increase in stalk weight and percent juice sucrose. Also, first stubble yields were higher when the plant cane was harvested in December than earlier in the season.

In a stubble protection test, a soil cover applied over the cane stubbles immediately after harvesting first stubble increased the sugar yield per acre of second stubble 19.8%. The increase occurred only where the soil cover was not removed by shaving in the spring. This shows that a soil cover over stubbles for freeze protection can increase yield even when following relatively mild winter conditions. In a stubble longevity test, the average plant cane yield of two varieties was increased with an NPK starter fertilizer applied at planting time. A starter fertilizer in addition to normal spring-applied fertilizers can apparently produce a strong root system and increase yields in plant and stubble cane crops.

OBJECTIVES:

This research is designed to provide information on cultural practices in an effort to help cane growers to produce maximum economic yields and to increase profitability in sugarcane production. This annual progress report is presented to provide the latest available data on certain practices and not as a final recommendation for growers to use all of these practices. Recommendations are based on several years of research data.

RESULTS AND DISCUSSION:

Nine field experiments were conducted in 1995 on the St. Gabriel Research Station to test the effects of various cultural and land management practices on the yield and yield components of sugarcane. The new cane varieties released from the breeding programs in the LAES at St. Gabriel and in the USDA at Houma were included in the experiments to determine varietal differences with the various practices.

The winter temperatures in the Baton Rouge area prior to the 1995 crop were mild, with 14 days below freezing and a minimum of 28°F. The cane yields of all varieties in the experiments were above normal apparently due to a good growing season and mild temperatures during the harvest season.

Date and Rate of Planting

An experiment was initiated to test the effects of planting dates on the plant cane yield of four varieties of sugarcane. The dates were August 1, September 7, October 3, and November 1, 1994. The varieties tested were CP 70-321, LCP 82-089, LHo 83-153, and LCP 85-384. Each variety was planted on each date using a 3-stalk planting rate. Also, rates of planting consisting of 2-, 3-, and 4- stalks were tested on the September, October, and November planting dates with varieties LCP 82-089 and LCP 85-384.

The data obtained on dates of planting in plant cane in 1995 are reported in Table 1. Generally, the plant cane yields were higher from the August planting than the other dates in CP 70-321 and LHo 85-153, but higher from the November planting than the other dates in LCP 82-089. The planting dates did not affect the yield of LCP 85-384. As an average of varieties the cane and sugar yields from the September and October dates were similar, but lower than the August and November dates.

The data obtained on rates and dates of planting in varieties LCP 82-089 and LCP 85-384 are reported in Table 2. The results show that the effects of planting dates on yield were more pronounced in LCP 82-089 than LCP 85-384, especially at the 2- and 3- stalk plant rates. The effects of plant dates with a 4-stalk rate were small. As an average of varieties, the October planting date produced less yield than the other dates and a 4-stalk rate produced more yield than the other planting rates.

Other experiments were conducted in 1995 from plant cane in 1994 to test the effects of dates and rates of planting on first stubble yield of different varieties. In the date test, varieties CP 74-383, LCP 82-089, LHo 83-153 and LCP 85-384 were planted on August 15, September 1, October 3, and November 1 in 1993. In the rate test, varieties LCP 82-089 and LCP 85-384 were planted using 2-, 3- and 4- stalk rates on the last three dates in 1993. Data were obtained in plant cane in 1994 and first stubble in 1995. The data on dates of planting in first stubble are reported in Table 3. The results show that the November planting date produced less cane yield than the other dates in LCP 82-089 and the October date produced more yield than the other dates in LHo 83-153. The planting dates did not affect first stubble yields in the other varieties and in the average of all four varieties.

The data obtained on the rates and dates of planting in first stubble cane of varieties LCP 82-089 and LCP 85-384 are reported in Table 4. The results show that the stubble yield in LCP 85-384 was higher from the November than September planting date with a 4-stalk rate and higher with a 4-stalk than a 2-stalk rate for the November planting date. The mean effects of rates and dates of planting on stubble cane yield were small.

Depth of Seedcane Cover

An experiment was initiated to test the effects of seed cover depth and shaving on the plant cane yield of LHo 83-153 and LCP 82-089. The rows in all plots were furrowed for planting at a normal depth and the cover depths tested were 3-4, 5-6, and 7-8 inches of packed soil. Seed cane of each variety was planted and covered with each soil depth in 1993. A shave and no shave treatment were applied to each cover depth in spring of 1994. The shave treatment left 3 inches of soil on all the shave plots. Data were collected in plant cane in 1994 and in first stubble in 1995 without any further treatment. The effects of seed cover depths and shaving in plant cane on the yield of first stubble cane are reported in Table 5. The stubble yield was lower with a seed cover 3-4 inches deep than the other depths on the check plot in LCP 82-089 and lower with a seed cover 3-4 inches than 7-8 inches on the shaved plot in LHo 83-153. The mean effect data show that the stubble sugar yields per acre increased with increasing seed cover depths. However, the plant cane yield in 1994 was lower with the 7-8 inches of cover than the other depths.

Date of Harvest

Experiments were conducted in 1995 to test the effects of different harvest dates in plant cane of the newer varieties on yield of plant cane and the subsequent stubble crop in the following year. One test was initiated to measure the effects of harvest dates in plant cane in 1994 and first stubble in 1995. Varieties CP 74-383, LCP 82-089, LHo 83-153, and LCP 85-384 were harvested on September 7, October 3, November 1, and December 1 in 1994. The effects of plant cane harvest dates on first stubble yield in 1995 are reported in Table 6. The results show that the December plant cane harvest date produced more first stubble yield than the other dates in CP 74-383 and LCP 85-384 and more than the September and October dates in LCP 82-089. As an average of varieties, the December date produced more first stubble sugar yield than the other plant cane harvest dates.

Another test was conducted to measure the effects of harvest dates in plant cane on yield of plant cane in 1995 and first stubble cane in 1996. Varieties CP 70-321, LCP 82-089, LHo 83-153, and LCP 85-384 were harvested in plant cane on September 1, October 2, November 6 and December 4 in 1995. The yields for the last three harvest dates are reported in Table 7. The results show that large increases in cane and sugar yields occurred in each variety during the harvest season except in LCP 85-384. The increases in sugar yield per acre were due to increases in stalk yield and percent sucrose during the season. The small differences in cane yield in LCP 85-384 were apparently due to the limitation in the topping height of harvesters in tall cane. The average sugar yield per acre increased 38.3% during October and 11.6% during November. This test will be continued in 1996 to measure effects of plant cane harvest dates on first stubble yields.

Stubble Protection From Freeze Damage

An experiment was conducted in 1995 to test the effects of stubble protection from freeze damage with a soil cover applied over the cane stubbles during the winter months. The experiment was initiated in 1993 to test the effects of stubble soil cover after two harvest dates in plant cane of two varieties with and without shaving in spring to remove the soil cover. Varieties LCP 82-089 and LHo 83-153 were harvested as plant cane on October 1 and December 1 in 1993 and the cover treatment was applied immediately after each harvest date. The cover treatment was applied again after harvesting first stubble on one date in November 1994. The shave treatment was applied in the spring of each crop year.

The data obtained in second stubble cane in 1995 are reported in Table 8. Results show that the stubble cane yields were increased with a soil cover with each variety and harvest date. However, the soil cover did not increase yield where it was removed by shaving in the spring. The soil cover without shaving increased the average cane yield 20.4% and sugar yield per acre 19.8%. Similar yield increases from a soil cover were obtained in first stubble cane in this test last year. This shows that significant benefits can be obtained in yield and longevity of stubble crops from a soil cover even when following relatively mild winter conditions. The soil covering operation with disk choppers deepens the water furrows to improve drainage during the winter months and the soil cover protects and promotes the early germination of the best top buds on cane stubbles in early spring.

Stubble Cane Longevity Test

An experiment was initiated in plant cane in 1995 to test the effects of fall-applied starter fertilizers, Furadan, and stubble soil cover protection on the yield and longevity of stubble cane. Varieties CP 70-321 and LCP 85-384 were planted in the test in 1994. A 90-90-90 NPK fertilizer was applied in the fall at planting time and a Furadan treatment at 1.5 lbs./A A.I. was applied at planting time and in spring in 1995. A soil cover treatment over the cane stubble was applied after harvesting plant cane in 1995. The effects of the starter fertilizers and Furadan were measured in plant cane in 1995 and the effects of all three treatments will be measured in first stubble in 1996. The results obtained in plant cane are reported in Table 9. The starter fertilizer applied in the fall at planting time increased the cane and sugar yields in LCP 85-384 and as an average of both varieties. The Furadan application did not increase yield in this test.

Table 1. Effect of date of planting on the plant cane yield of four cane varieties on the St. Gabriel Research Station, 1995.

Variety of cane	Date of planting	Plant cane yield	Stalk		Normal juice		Sugar yield
			No.	Wt.	Brix	Sucrose	
	1994	T/A	1000/A	lbs.	%	%	lbs/A
CP 70-321	Aug. 1	39.8	35.1	2.37	17.1	14.9	8.6e+15
	Sept. 7	32.2	30.0	2.59	17.2	15.1	
	Oct. 3	34.8	28.6	2.77	16.8	14.7	
	Nov. 1	36.9	32.3	2.35	16.5	14.3	
LCP 82-089	Aug. 1	31.0	40.4	2.09	17.4	14.9	6.7e+15
	Sept. 7	32.2	39.1	2.28	17.7	15.3	
	Oct. 3	26.7	28.7	2.44	17.3	15.2	
	Nov. 1	34.5	31.9	2.47	16.9	14.3	
LHo 83-153	Aug. 1	37.7	40.3	2.09	18.2	15.9	8.7e+15
	Sept. 7	30.9	37.6	2.12	17.8	15.4	
	Oct. 3	30.1	30.4	2.33	17.6	15.3	
	Nov. 1	33.6	34.8	2.23	17.6	15.2	
LCP 85-384	Aug. 1	39.7	43.1	1.87	16.7	14.4	8.2e+15
	Sept. 7	38.4	44.1	2.08	17.1	14.9	
	Oct. 3	37.7	37.3	2.50	17.4	15.3	
	Nov. 1	39.8	41.5	2.12	16.5	14.2	
LSD .05 Treatments		3.3	3.8	0.35	0.6	0.7	847
		Mean effect					
	Aug.1	37.0	39.7	2.10	17.4	15.0	8.0e+15
	Sept. 7	33.4	37.7	2.27	17.4	15.2	
	Oct. 3	32.3	31.3	2.51	17.3	15.1	
	Nov. 1	36.2	35.1	2.29	16.9	14.5	
LSD .05 Means		1.6	1.9	0.17	0.3	0.3	424

Planted with a 3-stalk rate on each date in 1994.

Table 2. Effect of date and rate of planting on the plant cane yield of two cane varieties on the St. Gabriel Research Station, 1995.

Variety of cane	Date of planting	Rate of planting	Plant cane yield	Stalk		Normal juice sucrose	Sugar yield
				No.	Wt.		
	1994	Stalks	T/A	1000/A	lbs.	%	lbs/A
LCP 82-089	Sept. 7	2	33.9	35.9	2.34	15.3	7522
		3	32.2	39.1	2.28	15.3	7155
		4	37.7	39.9	2.29	15.5	8454
	Oct. 3	2	25.1	25.9	2.63	14.7	5298
		3	26.7	28.7	2.44	15.2	5863
		4	34.1	29.6	2.58	15.6	7748
	Nov. 1	2	34.1	29.5	2.68	15	7410
		3	34.5	31.9	2.47	14.3	7661
		4	35.6	32.7	2.73	14.9	7663
LCP 85-384	Sept. 7	2	41.5	37.6	2.33	15.3	9202
		3	38.4	44.1	2.08	14.9	8228
		4	41.7	40.3	1.97	15.3	9215
	Oct. 3	2	36.2	33.4	2.54	15.1	7872
		3	37.7	37.3	2.5	15.3	8355
		4	40.9	43.1	2.49	14.7	8664
	Nov. 1	2	42.2	42.7	2.53	15.2	9279
		3	39.8	41.5	2.12	14.2	8078
		4	39.7	45.4	2.25	14.5	8268
LSD .05 Treatments			2.9	5.2	0.41	0.7	829
			Mean effect				
	Sept. 7		37.6	39.5	2.21	15.3	8296
	Oct. 3		33.5	33	2.53	15.1	7300
	Nov. 1		37.6	37.3	2.46	14.7	7960
		2	35.5	34.2	2.51	15.1	7764
		3	34.9	37.1	2.31	14.9	7457
		4	38.3	38.5	2.38	15.1	8336
LSD .05 Means			1.2	2.1	0.17	NS	339

Table 3. Effect of date of planting on the first stubble cane yield of four cane varieties on the St. Gabriel Research Station, 1995.

Variety of cane	Date of planting	Stubble cane yield	Stalk		Normal juice		Sugar yield
			No.	Wt.	Brix	Sucrose	
	1993	T/A	1000/A	lbs.	%	%	lbs/A
CP 74-383	Aug. 15	38.2	41.5	2.20	17.3	15.2	8423
	Sept. 1	38.7	43.4	2.10	17.4	15.1	8422
	Oct. 3	40.1	45.6	2.26	17.7	15.7	9184
	Nov. 1	38.5	40.8	2.33	17.4	15.3	8539
LCP 82-089	Aug. 15	35.6	43.2	1.90	17.8	15.7	8110
	Sept. 1	36.0	42.5	2.04	17.9	16.0	8399
	Oct. 3	36.1	44.5	2.14	17.3	15.1	7846
	Nov. 1	31.8	43.6	1.96	18.1	15.9	7388
LHo 83-153	Aug. 15	35.3	45.5	1.95	18.5	16.5	8551
	Sept. 1	34.9	45.2	1.77	17.9	15.8	8015
	Oct. 3	39.5	49.9	1.88	18.1	16.0	9201
	Nov. 1	36.3	44.4	2.03	18.5	16.4	8745
LCP 85-384	Aug. 15	37.9	50.7	1.75	17.8	15.9	8764
	Sept. 1	37.5	50.3	1.70	17.5	15.7	8573
	Oct. 3	36.4	54.0	1.81	17.8	16.0	8512
	Nov. 1	40.0	51.3	2.02	17.9	16.0	9362
LSD .05 Treatments		3.3	3.1	0.18	0.4	0.4	779
		Mean date effect					
	Aug. 15	36.8	45.2	1.95	17.9	15.8	8462
	Sept. 1	36.8	45.4	1.90	17.7	15.6	8352
	Oct. 3	38.0	48.5	2.02	17.7	15.7	8686
	Nov. 1	36.7	45.0	2.08	18.0	15.9	8509
LSD .05 Means		NS	1.6	0.09	0.2	0.2	NS

Planted with a 3-stalk rate on each date in 1993.

Table 4. Effect of date and rate of planting on the first stubble cane yield of two cane varieties on the St. Gabriel Research Station, 1995.

Variety of cane	Date of planting	Rate of planting	Stubble cane yield	Stalk		Normal juice sucrose	Sugar yield
				No.	Wt.		
	1993	Stalks	T/A	1000/A	lbs.	%	lbs/A
LCP 82-089	Sept. 1	2	32.5	41.7	2.05	15.9	7538
		3	36.0	42.5	2.04	16.0	8399
		4	35.6	44.8	1.85	15.8	8169
	Oct. 3	2	35.5	42.3	2.24	15.8	8197
		3	36.1	44.5	2.14	15.1	7846
		4	35.4	46.3	1.97	15.4	7913
	Nov. 1	2	34.8	42.9	2.00	16.4	8383
		3	34.1	43.6	1.96	15.9	7914
		4	34.7	44.7	1.85	16.3	8269
LCP 85-384	Sept. 1	2	39.0	47.3	2.11	16.1	9181
		3	37.5	50.3	1.70	15.7	8573
		4	38.6	52.0	1.82	15.7	8837
	Oct. 3	2	40.5	53.4	1.96	15.8	9306
		3	39.2	54.0	1.81	16.0	9176
		4	39.7	54.6	2.02	15.7	9038
	Nov. 1	2	36.2	52.0	1.84	16.1	8529
		3	40.0	51.3	2.02	16.0	9362
		4	43.3	55.2	1.76	16.1	10209
LSD .05 Treatments			4.3	3.2	0.17	0.5	988
			Mean effect				
	Sept. 1		36.5	46.4	1.93	15.9	8449
	Oct. 3		37.7	49.2	2.02	15.6	8579
	Nov. 1		37.2	48.3	1.90	16.2	8778
		2	36.4	46.6	2.03	16.0	8522
		3	37.1	47.7	1.94	15.8	8545
		4	37.9	49.6	1.88	15.8	8739
LSD .05 Means			NS	1.3	0.07	0.2	NS

Table 5. Effect of depth of seed cover and shaving on the first stubble cane yield of two varieties of sugarcane on a Commerce soil on the St. Gabriel Research Station, 1995.

Seed cover depth	Shave treat.	Stubble cane yield	Stalk		Normal juice		Sugar yield
			No.	Wt.	Brix	Sucrose	
inches		T/A	1000/A	lbs.	%	%	lbs/A
				LCP 82-089			
3-4	Check	33.6	37.5	2.04	17.1	14.6	7015
	Shave	34.8	38.2	2.22	17.3	14.6	7278
5-6	Check	37.2	42.9	1.90	17.3	14.6	7801
	Shave	33.5	42.0	1.97	17.0	14.3	6862
7-8	Check	35.7	43.4	1.97	17.4	14.7	7569
	Shave	34.4	43.2	1.96	17.8	15.2	7553
				LHo 83-153			
3-4	Check	34.4	43.7	1.89	17.2	14.6	7226
	Shave	33.5	42.2	1.99	17.0	14.3	6867
5-6	Check	35.0	38.7	2.18	17.6	15.0	7577
	Shave	34.3	40.1	1.94	17.5	14.8	7329
7-8	Check	35.6	37.9	2.09	17.7	15.1	7751
	Shave	36.4	38.7	2.00	17.6	14.6	7641
LSD .05 Treatments		2.4	3.4	0.23	0.6	0.7	530
				Mean effect			
3-4		34.1	40.4	2.04	17.2	14.5	7097
5-6		35.0	40.9	2.00	17.3	14.7	7392
7-8		35.5	40.8	1.99	17.6	14.9	7629
	Check	35.3	40.7	2.01	17.4	14.8	7490
	Shave	34.5	40.8	2.01	17.4	14.6	7255
LSD .05 Depth Means		1.2	NS	NS	0.3	0.4	265
LSD .05 Shave Means		NS	NS	NS	NS	NS	216

The seed cover depth treatments were applied at planting time in 1993 and the shave treatment to remove excessive soil cover over the seed was applied in spring 1994.

Table 6. Effect of date of harvesting plant cane on yield of the subsequent stubble cane of four varieties on Commerce soil on the St. Gabriel Research Station, 1995.

Variety of cane	Date of plant cane harvest	First stubble yield	Stalk		Normal juice		Sugar yield
			No.	Wt.	Bri x	Sucrose	
	1994	T/A	1000/A	lbs.	%	%	lbs/A
CP 74-383	Sept. 7	39.5	39.4	2.32	17.4	14.8	8389
	Oct. 3	35.3	39.0	1.99	17.6	15.0	7656
	Nov. 1	37.9	40.3	2.16	17.3	14.6	7981
	Dec. 1	45.3	47.2	2.21	17.1	14.5	9457
LCP 82-089	Sept. 7	37.3	44.3	2.05	18.4	15.7	8511
	Oct. 3	38.0	45.4	2.00	17.7	15.1	8270
	Nov. 1	43.1	47.0	1.97	17.5	14.8	9214
	Dec. 1	45.9	53.0	1.97	17.7	14.9	9883
LHo 83-153	Sept. 7	36.5	41.8	1.98	17.6	14.9	7835
	Oct. 3	33.2	40.7	1.73	17.7	15.2	7287
	Nov. 1	32.7	43.5	1.84	17.8	15.2	7210
	Dec. 1	36.0	53.5	1.74	17.6	15.0	7797
LCP 85-384	Sept. 7	46.9	55.4	1.91	17.5	15.0	10185
	Oct. 3	44.9	55.1	2.06	17.9	15.4	10043
	Nov. 1	45.8	54.3	2.02	17.2	14.7	9703
	Dec. 1	49.5	57.0	2.06	17.2	14.8	10505
LSD .05 Treatments		2.9	3.2	0.29	0.5	0.6	751
				Mean date effect			
	Sept. 7	40.1	45.3	2.06	17.7	15.1	8730
	Oct. 3	37.8	45.0	1.94	17.7	15.2	8314
	Nov. 1	39.9	46.3	2.00	17.5	14.9	8527
	Dec. 1	44.2	52.7	1.99	17.4	14.8	9410
LSD .05 Means		1.5	1.6	NS	0.3	0.3	375

Plant cane was harvested on different dates in 1994 and first stubble yields were measured in 1995.

Table 7. Effect of date of harvest on the yield of four varieties of plant cane on Commerce soil on the St. Gabriel Research Station, 1995.

Variety of cane	Date of plant cane harvest	Plant cane yield	Stalk		Normal juice		Sugar yield
			No.	Wt.	Brix	Sucrose	
	1995	T/A	1000/A	lbs.	%	%	lbs/A
CP 70-321	Oct. 2	27.3	27.8	2.37	15.7	12.5	4736
	Nov. 6	30.9	28.3	2.61	16.6	14.4	6374
	Dec. 4	34.5	28.7	2.40	17.3	14.9	7384
LCP 82-089	Oct. 2	30.4	34.3	2.00	15.5	12.0	5040
	Nov. 6	35.4	42.1	2.51	17.1	14.7	7457
	Dec. 4	36.3	42.6	1.83	18.3	15.8	8346
LHo 83-153	Oct. 2	23.1	29.8	1.74	15.0	11.2	3516
	Nov. 6	28.7	37.0	1.91	16.4	14.2	5855
	Dec. 4	31.1	33.8	2.13	17.5	15.0	6759
LCP 85-384	Oct. 2	36.3	38.5	1.97	15.7	12.6	6396
	Nov. 6	37.5	43.0	2.18	16.3	14.1	7563
	Dec. 4	36.7	42.4	2.06	17.3	14.9	7900
LSD .05 Treatment		3.1	3.1	0.36	0.8	0.8	645
		Mean effect					
	Oct. 2	29.3	32.6	2.02	15.5	12.1	4922
	Nov. 6	33.1	37.6	2.30	16.6	14.4	6807
	Dec. 4	34.7	36.9	2.11	17.6	15.2	7597
LSD .05 Means		1.6	1.5	0.18	0.4	0.4	322

The plant cane of each variety was harvested on four dates and the yields were measured on the last three dates in 1995.

Table 8. Effect of stubble protection on the second stubble yield of two cane varieties on the St. Gabriel Research Station, 1995.

Date of plant cane harvest	Stubble protection treatment	Second stubble yield	Stalk		Normal juice		Sugar yield
			No.	Wt.	Brix	Sucrose	
1993	1994	T/A	1000/A	lbs.	%	%	lbs/A
				LCP 82-089			
Oct. 1	Check	28.9	38.3	1.74	16.2	13.0	5280
	Cover-shave	27.7	30.6	1.63	16.4	13.3	5198
	Cover	34.9	41.3	1.92	16.4	13.5	6645
Dec. 1	Check	31.3	40.3	1.83	15.8	12.7	5570
	Cover-shave	28.8	37.1	1.96	16.7	13.8	5658
	Cover	39.4	42.5	2.12	16.2	13.0	7223
				LHo 83-153			
Oct. 1	Check	27.4	36.6	1.79	16.2	13.3	5138
	Cover-shave	26.4	34.7	1.65	15.6	12.7	4675
	Cover	34.0	44.9	1.68	15.2	12.1	5725
Dec. 1	Check	27.9	44.0	1.46	16.1	13.1	5121
	Cover-shave	27.2	41.4	1.65	16.4	13.5	5182
	Cover	30.8	42.5	1.83	15.9	13.1	5689
LSD .05 Treatments		2.7	3.5	0.30	1.0	1.2	908
				Mean effect			
	Check	28.9	39.8	1.71	16.1	13.0	5277
	Cover-shave	27.5	35.9	1.72	16.3	13.3	5178
	Cover	34.8	42.8	1.89	15.9	12.9	6321
LSD .05 Means		1.4	1.8	0.15	NS	NS	455

The soil cover was applied on the cane stubbles immediately after harvesting plant cane on each date in 1993 and after harvesting first stubble in November, 1994. The cover-shave plots were covered in the fall and shaved in the spring to remove cover each year.

Table 9. Effect of fall applied fertilizer and Furadan on plant cane yield of two varieties of cane on the St. Gabriel Research Station, 1995.

Fall Fertilizer $N-P_2O_5-K_2O$	Furadan	Plant cane yield	Fallow planted cane				Sugar yield
			Stalk		Normal juice		
			No.	Wt.	Brix		
				Sucrose			
lbs/A		T/A	1000/A	lbs.	%	%	lbs/A
				CP 70-321			
0-0-0	Check	33.5	31.3	2.17	16.9	14.5	6936
90-90-90	Check	35.7	30.9	2.60	16.8	14.4	7380
90-90-90	Furadan	30.1	32.6	2.71	17.3	15.0	6529
				LCP 85-384			
0-0-0	Check	39.2	44.4	2.27	16.5	14.1	7864
90-90-90	Check	43.8	48.7	2.12	17.2	14.8	9299
90-90-90	Furadan	41.8	47.7	1.82	16.1	13.8	8129
LSD .05 Treatment		3.6	4.0	0.43	1.0	1.1	769
				Mean effect			
0-0-0	Check	36.3	37.9	2.22	16.7	14.3	7400
90-90-90	Check	39.7	39.8	2.36	17.0	14.6	8340
90-90-90	Furadan	35.9	39.1	2.27	16.7	14.4	7329
LSD .05 Means		2.6	NS	NS	NS	NS	544

This is a stubble longevity test in which a stubble protection treatment was applied after harvesting plant cane in 1995.

SOIL FERTILITY RESEARCH IN SUGARCANE IN 1995

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in cooperation with
St. Gabriel Research Station and W. B. Hallmark and
L. P. Brown at the Iberia Research Station

SUMMARY:

Five field experiments were conducted in 1995 to test the effects of rates and time of fertilization on the yield components of sugarcane grown on different soil types. The experiments were in fallow and succession planted cane with the newer cane varieties. Results from a test with rates of N x P x K plus S and fall fertilizer treatments on a Baldwin clay soil show that stubble cane yields were increased with 80 lbs/A of N, but not with higher N rates. The yield increases from P, K, and S and from fall-applied fertilizer were small on this soil type. In an N x P x K test plus S and lime treatments on a Coteau soil, the yield responses to each treatment in first stubble cane were unusually small.

Fall- and spring-applied NPK fertilizers were tested in fallow and succession planted cane on a Commerce soil. In fallow cane, plant cane and first stubble yields were increased with spring-applied N and NPK fertilizers only where fall fertilizer was not applied at planting time. The fall-applied starter fertilizers did not increase yields in fallow planted cane this year. In succession cane, first stubble cane yields were increased with spring-applied N and NPK fertilizers with each rate of starter fertilizers applied in the fall. The average cane yields were similar for each starter fertilizer rate tested, but significantly higher than the check plot yield. Furadan increased yields only with a low fall fertilizer rate.

OBJECTIVES:

This research was designed to provide information on soil fertility in an effort to help cane growers to produce maximum economic yields and to increase profitability in sugarcane production. This annual progress report is presented to provide the latest available data on certain practices and not as a final recommendation for growers to use all of these practices. Recommendations are based on several years of research data.

RESULTS AND DISCUSSION:

Five experiments were conducted in 1995 at several locations to test the effects of rates of fertilization on the yield of fallow and succession planted sugarcane. The fallow cane was planted after a fallow year in a normal cane rotation, and the succession cane was planted immediately after harvesting a stubble cane crop without a fallow year.

Rates of N, P, K, and S Fertilizers

An experiment was continued to test rates of N, P, K, and S fertilizers on yield of second stubble cane on a Baldwin clay soil on the Iberia Research Station. The rates consisted of 80, 160, and 240 lbs/A of N, 0, and 60 lbs/A of phosphate and 0 and 80 lbs/A of potash in all possible combinations. In addition a fall-applied 90-90-90 NPK fertilizer and a 24 lbs/A rate of sulfur were tested with some of the NPK treatments. The fall fertilizer was applied in the planting furrow. The second stubble yield data obtained at harvest time are reported in Table 1. The cane and sugar yields per acre from 80 lbs/A of N and from all the NPK treatment combinations were significantly higher than the check plot yield. The yield from the 160-60-80 was higher than the yield from 160-0-0 treatment. The yield increases from the fall-applied NPK and sulphur were small. A factorial analysis of the data showed that N rates above 80 lbs/A did not increase the cane and sugar yields. The mean effects of P and K fertilizers on each yield component were small.

Rates of N, P, K, and S Fertilizers and Lime

An experiment was initiated to test rates of N, P, K, and S fertilizers and dolomite lime on the yield of first stubble cane on Viator Farm on a Coteau sil soil in Lafayette Parish. The rates consisted of 80, 160, and 240 lbs/A of N, 0, and 60 lbs/A of phosphate and 0 and 80 lbs/A of potash in all possible combinations. In addition, a 24 lbs/A rate of sulphur and a 1 T/A rate of dolomite lime were tested with one fertilizer treatment. The lime rate was broadcasted and incorporated into the soil in one treatment and applied in the planting furrow in another treatment. The yield data obtained in 1995 are reported in Table 2. The results show that the effects of N alone and each treatment combinations on the yield components of first stubble in the test were small. Also, a factorial analysis showed that the mean effects of N, P, and K fertilizers on each yield component were not significant. These small responses to applied fertilizers are unusual for this soil type, especially in stubble cane.

Starter Fertilizers in Plant Cane of Fallow Planted Cane

An experiment was initiated to test the effects of NPK fertilizer rates applied as a starter fertilizer in the fall at planting time in addition to spring-applied fertilizers in fallow planted cane. The starter fall rates were 0-0-0, 15-45-45, 45-0-45, 45-45-0, 45-45-45, and 90-90-90. Spring rates consisting of 120-0-0 and 120-40-80 were applied over each fall rate. The test was planted with CP 70-321 after a fallow year, and the fall treatments were applied in the planting furrow. The spring treatments were applied in the off-bar furrow in 1995, and the data obtained in plant cane are reported in Table 3.

The results show that the N and NPK spring treatments without fall-applied fertilizer increased the cane yield, stalk population, and sugar yield per acre over the check plot. However, the increases from NPK over N were small with and without fall-applied fertilizer. The mean effect data show that the fall-applied fertilizer treatments did not increase yield in this test.

Starter Fertilizer in First Stubble Cane of Fallow Planted Cane

An experiment was initiated to test the effects of NPK fertilizer rates applied as a starter fertilizer in the fall at planting time in addition to spring-applied fertilizers in fallow planted cane. The starter fall rates tested were 0-0-0, 15-45-45, 45-45-45, and 90-90-90 lbs/A of NPK. Spring rates consisting of 160-0-0, 160-0-80, and 160-40-80 were applied over each fall rate. The test was planted with CP 70-321 after a fallow year and the fall treatments were applied in the planting furrow. The spring treatments were applied in the off-bar furrow in plant cane in 1994 and first stubble in 1995. The data obtained in first stubble cane are reported in Table 4.

The results show that the N, NK, and NPK spring treatments without fall-applied fertilizer increased the cane yield, stalk population, and sugar yield per acre. The increases from the NK and NPK over the N were significant without fall fertilizer and as an average of fall fertilizer rates. The mean effect data show that the fall-applied fertilizer treatments did not increase yield in this first stubble test in fallow planted cane.

Starter Fertilizer in First Stubble Cane of Succession Planted Cane

An experiment was initiated to test the effects of NPK fertilizer rates applied as a starter fertilizer in the fall in addition to spring-applied fertilizers on the yield of succession planted cane. The starter fall rates were the same as in the above fallow planted test. Spring rates consisting of 0-0-0, 160-0-0, 160-40-80 and 160-40-80, + Furadan were applied over each fall rate. The test was planted with LCP 85-384 in succession immediately after harvesting a cane crop in 1993. The fall treatments were applied in the planting furrow and the spring treatments in the off-bar furrow in 1994 and in 1995.

The data obtained in first stubble cane are reported in Table 5. The results show that the N and NPK spring treatments increased cane and sugar yields with each starter fall rate. The Furadan increased cane yield only with the 15-45-45 fall rate. The fall rates without additional fertilizer applied in the spring increased yields 13.4% with 15-45-45, 8.7% with 45-45-45, and 19.4% with 90-90-90. The mean effect data show that the cane yields were similar for each applied fall rate, but significantly higher than the check plot yield. Also, the cane yields from the N and NPK spring rates were similar but higher than the check plot yield. This shows that yields of first stubble in succession cane can be increased with a starter fertilizer at planting time and possibly with Furadan at low starter fertilizer rates.

Table 1. Effect of rate of fertilizer application on the yield of second stubble on a Baldwin clay soil on the Iberia Research Station in Iberia Parish, 1995.

Fertilizer applied $N-P_2O_5-K_2O$	Second stubble yield	Stalk		Normal juice		Sugar yield
		No.	Wt.	Brix	Sucrose	
lbs/A	T/A	1000/A	lbs.	%	%	lbs/A
0-0-0	23.4	26.0	1.78	15.9	13.5	4469
80-0-0	28.6	28.8	2.00	16.8	14.4	5869
80-60-0	28.7	29.8	2.18	17.2	14.8	6111
80-0-80	27.7	30.2	2.19	16.8	14.5	5740
80-60-80	29.6	29.6	2.25	16.4	14.1	5984
160-0-0	29.2	29.1	2.12	16.9	14.5	6051
160-0-0 + Fall NPK	30.3	29.7	2.21	16.9	14.5	6289
160-60-0	29.1	30.1	2.03	16.8	14.4	5998
160-0-80	30.1	30.9	1.95	17.1	14.7	6378
160-60-80	32.5	32.1	2.19	17.2	14.8	6900
160-60-80 + 24 S	30.5	30.6	2.04	17.1	14.7	6430
160-60-80 + Fall NPK	30.4	32.1	2.11	16.8	14.4	6276
240-0-0	29.1	29.6	1.91	16.8	14.4	5969
240-60-0	29.5	30.3	2.00	16.7	14.3	6047
240-0-80	29.0	30.0	2.01	16.6	14.1	5819
240-60-80	31.0	30.8	2.06	16.9	14.4	6365
LSD .05	3.1	2.9	0.27	0.6	0.6	688

Fall NPK = 90-90-90 lbs/A applied at planting time.
24S = 24 lbs/A of sulphur
This experiment was conducted in cooperation with W. B. Hallmark and L. P. Brown at the Iberia Research Station.

Table 2. Effect of rate of fertilizer application on the yield of first stubble cane on a Coteau sil soil on Viator Farm in Lafayette Parish, 1995.

Fertilizer applied $N-P_2O_5-K_2O$	First stubble yield	Stalk		Normal juice		Sugar yield
		No.	Wt.	Brix	Sucrose	
lbs/A	T/A	1000/A	lbs.	%	%	lbs/A
0-0-0	29.7	33.8	1.90	16.9	13.9	5885
80-0-0	29.5	33.7	1.89	16.7	13.4	5581
80-60-0	29.2	33.7	1.97	16.8	13.6	5631
80-0-80	30.3	32.9	1.83	16.5	13.5	5751
80-60-80	30.9	33.0	1.96	16.8	13.8	6027
160-0-0	30.9	33.1	1.90	16.9	13.8	6040
160-60-0	28.6	33.1	1.81	16.9	13.8	5614
160-0-80	28.8	31.6	1.89	17.0	13.8	5665
160-60-80	31.4	32.6	1.90	16.8	13.8	6167
160-60-80 + S[1/]	32.2	35.1	1.95	16.8	13.7	6227
160-60-80 + S + Lime[2/]	30.6	34.5	1.95	16.7	13.5	5843
160-60-80 + S + Lime[3/]	30.9	34.7	1.89	16.3	13.2	5769
240-0-0	28.8	32.5	1.98	16.8	13.7	5591
240-60-0	28.8	34.2	1.89	17.0	13.6	5537
240-0-80	32.0	35.1	1.94	17.0	13.6	6188
240-60-80	29.4	33.6	1.88	16.8	13.5	5615
LSD .05	3.4	1.8	NS	NS	NS	NS

[1/]Sulphur at 24 lbs/A rate applied in off-bar furrows.
[2/]Dolomite lime at 1 T/A broadcasted and incorporated before planting.
[3/]Dolomite lime at 1 T/A applied in planting furrows.

This experiment was in cooperation with Dr. W. B. Hallmark and L. P. Brown at the Iberia Research Station.

Table 3. Effect of fall- and spring-applied fertilizer on the yield of plant cane CP 70-321 planted after a fallow year on Commerce soil on the St. Gabriel Research Station, 1995.

Fertilizer applied $N-P_2O_5-K_2O$		Plant Cane - Fallow planted					
		Cane	Stalk		Normal juice		Sugar
Fall	Spring	yield	No.	Wt.	Brix	Sucrose	yield
lbs/A	lbs/A	T/A	1000/A	lbs.	%	%	lbs/A
0-0-0	0-0-0	30.6	24.6	2.82	16.4	14.3	6266
	120-0-0	38.1	29.5	2.81	16.3	14.0	7604
	120-40-80	39.2	31.1	2.92	16.1	14.0	7821
15-45-45	120-0-0	34.9	26.1	3.09	16.9	14.8	7411
	120-40-80	35.1	26.8	2.95	16.8	14.7	7384
45-0-45	120-0-0	38.0	31.5	2.56	16.8	14.6	7948
	120-40-80	37.0	29.9	2.72	16.8	14.7	7319
45-45-0	120-0-0	36.8	29.5	3.15	16.5	14.2	7480
	120-40-80	34.4	30.1	2.65	16.6	14.3	7028
45-45-45	120-0-0	33.1	27.3	3.18	16.8	14.5	6898
	120-40-80	34.1	28.9	2.99	16.3	14.0	6517
90-90-90	120-0-0	33.8	34.7	2.58	16.9	14.7	7114
	120-40-80	34.6	34.5	2.80	16.6	14.5	7204
LSD .05 Treat.		2.9	2.5	0.45	0.6	0.6	562
		Mean effect					
0-0-0		38.7	30.3	2.86	16.2	14.0	7713
15-45-45		35.0	26.5	3.02	16.9	14.7	7397
45-0-45		37.5	30.7	2.64	16.8	14.6	7884
45-45-0		35.6	29.8	2.90	16.5	14.3	7254
45-45-45		33.6	28.1	3.08	16.6	14.3	6857
90-90-90		34.2	34.6	2.69	16.8	14.6	7159
	120-0-0	35.8	29.8	2.90	16.7	14.5	7409
	120-40-80	35.7	30.2	2.80	16.5	14.4	7345
LSD .05 Fall		2.1	1.8	0.31	0.4	0.4	413
LSD .05 Spring		NS	NS	NS	NS	NS	NS

Table 4. Effect of fall- and spring-applied fertilizer on the yield of first stubble cane CP 70-321 planted after a fallow year on Commerce soil on the St. Gabriel Research Station, 1995.

Fertilizer applied $N-P_2O_5-K_2O$		First stubble Cane - Fallow planted					
		Cane	Stalk		Normal juice		Sugar
Fall	Spring	yield	No.	Wt.	Brix	Sucrose	yield
lbs/A	lbs/A	T/A	1000/A	lbs.	%	%	lbs/A
0-0-0	0-0-0	21.4	25.3	2.14	16.5	13.9	4227
	160-0-0	30.7	32.4	2.28	16.4	13.7	5954
	160-0-80	34.3	34.1	2.41	16.6	14.0	6848
	160-40-80	34.2	33.7	2.35	17.0	14.2	6945
15-45-45	160-0-0	31.8	33.4	2.55	16.9	14.2	6452
	160-0-80	33.2	34.7	2.50	16.4	13.8	6495
	160-40-80	34.1	33.7	2.58	16.6	13.8	6700
45-45-45	160-0-0	31.0	34.0	2.42	17.0	14.2	6288
	160-0-80	32.5	34.3	2.23	16.5	13.8	6356
	160-40-80	31.9	34.8	2.23	16.8	14.1	6389
90-90-90	160-0-0	30.3	33.3	2.23	16.9	14.3	6217
	160-0-80	30.7	34.2	2.38	17.0	14.5	6402
	160-40-80	31.0	34.0	2.28	17.2	14.6	6490
LSD .05 Treatments		2.6	0.5	0.6	0.5	0.6	608
		Mean effect					
0-0-0		33.1	33.4	2.35	16.7	14.0	6582
15-45-45		33.0	33.9	2.54	16.6	13.9	6549
45-45-45		31.8	34.4	2.29	16.8	14.0	6348
90-90-90		30.7	33.8	2.27	17.0	14.5	6370
	160-0-0	30.9	33.3	2.37	16.8	14.1	6231
	160-0-80	32.7	34.3	2.38	16.6	14.0	6525
	160-40-80	32.8	34.0	2.34	16.9	14.2	6631
LSD .05 Fall Means		1.5	NS	0.19	0.3	0.4	NS
LSD .05 Spring Means		1.3	0.9	NS	0.3	NS	310

Table 5. Effect of fall- and spring-applied fertilizer on the yield of first stubble cane LCP 85-384 planted in succession on Commerce soil on the St. Gabriel Research Station, 1995.

Fertilizer applied $N-P_2O_5-K_2O$		First stubble Cane - Succession planted					
		Cane	Stalk		Normal juice		Sugar
Fall	Spring	yield	No.	Wt.	Brix	Sucrose	yield
lbs/A	lbs/A	T/A	1000/A	lbs.	%	%	lbs/A
0-0-0	0-0-0	25.3	36.0	1.79	17.4	15.3	5567
	160-0-0	34.0	41.2	2.04	17.3	15.1	7438
	160-40-80	39.7	44.2	2.04	17.4	15.2	8752
	160-40-80 + F	38.1	47.9	1.77	17.3	15.3	8434
15-45-45	0-0-0	28.7	37.1	1.95	17.6	15.4	6442
	160-0-0	42.3	47.4	2.11	17.4	15.4	9447
	160-40-80	38.1	46.1	1.79	17.5	15.5	8565
	160-40-80 + F	41.8	47.8	2.13	17.6	15.0	9019
45-45-45	0-0-0	27.5	41.1	1.74	17.8	15.8	6305
	160-0-0	41.4	48.9	2.20	17.2	15.4	9237
	160-40-80	42.3	46.8	2.06	17.3	15.3	9418
	160-40-80 + F	38.6	46.6	1.84	17.4	15.2	8530
90-90-90	0-0-0	30.2	45.1	1.73	17.9	16.1	7115
	160-0-0	38.9	49.1	1.87	17.2	14.9	8357
	160-40-80	40.0	49.7	2.07	17.3	15.2	8757
	160-40-80 + F	39.5	48.6	2.01	17.2	15.0	8565
LSD .05 Treatments		3.4	2.6	0.31	0.5	0.6	876
		Mean effect					
0-0-0		34.2	42.3	1.91	17.4	15.2	7448
15-45-45		37.7	44.6	2.00	17.5	15.3	8368
45-45-45		37.5	45.8	1.96	17.5	15.4	8354
90-90-90		37.2	48.1	1.92	17.4	15.3	8199
	0-0-0	27.9	39.8	1.90	17.7	15.7	6357
	160-0-0	39.2	46.7	2.05	17.3	15.2	8620
	160-40-80	40.0	46.7	1.99	17.4	15.3	8854
	160-40-80 + F	39.5	47.7	1.94	17.4	15.1	8637
LSD .05 Means		1.7	1.3	0.15	0.3	0.3	438

F = Furadan

SUGARCANE RESPONSE TO SUBSOILING ON CLAY SOIL
(Plantcane Response)

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Iberia Research Station

Summary:

The primary purpose of this study was to determine the necessity of subsoiling on heavy-textured, clayey soil. The influence of four subsoiling treatments on sugarcane was compared. The four treatments were: a control; parabolic subsoiling to a depth of 12 inches; parabolic subsoiling to a depth of 24 inches; and subsoiling to a depth of 24 inches with a vertical mulcher. Plantcane yields did not differ significantly among the treatments. Also, probing in the subsoil did not reveal differences in resistance.

Introduction:

Sugarcane growers have been exploiting the benefits of subsoiling fine-textured soil for the last few decades. There seems to be some uncertainty concerning the merits of subsoiling on clayey soil. It is believed that a form of subsoiling occurs naturally with the expansion and contraction occurring with certain types of clay. Recently, studies have demonstrated subsoiling is equivalent to irrigation for soybeans grown on clay soil in Mississippi. Even though soil cracking occurred on the soils being studied, the researchers suggested that the blocky structures, which are resistant to moisture penetration, are reduced in size with each subsoiling. A study was initiated in the summer of 1994 to determine the need for clay soil subsoiling for sugarcane. The soil type chosen for this study is a Baldwin silty clay loam, which is characterized by a loamy, friable surface and a blocky clay subsoil extending from 9 inches to approximately 30 inches in depth. Baldwin soil is the most prevalent alluvium for sugarcane production in the area.

Experimental Procedures:

Four subsoiling treatments were imposed on June 29, 1994, on soil which has been in sugarcane production for several cycles. The subsoilers evaluated were a conventional parabolic subsoiler and a vertical mulcher subsoiler. The vertical mulcher was configured to expand the soil 11 inches wide at the top and 5 inches wide at the bottom of the furrow, compared to approximately 1 1/2 inches in width for the parabolic. Its name is derived from its original design, which included a hopper to incorporate plant residue into the subsoil.

Research was supported by the American Sugar Cane League.

Plots were probed to determine soil compaction on August 16, 1994. LCP 85-384 was planted at two running stalks with a two joint overlap on September 6, 1994. Karmex was broadcast at the rate of 3.6 pounds/acre for preemergence weed control.

Plots were 3 rows wide and 50 feet long and arranged in a randomized block, with 5 replications. Agronomic practices were according to recommendations. Cane weight was measured with a tractor-mounted weigh rig on December 5, 1995. Analyses of variance were calculated for cane and sugar yields and their components.

Results:

The differences in sugar yield were relatively minor and insignificant among the subsoiling treatments. Fig. no. 1 shows the sugar yields were 8,954, 9,201, 9,354, and 9,477 pounds of sugar per acre, respectively, for the check, shallow parabolic, deep parabolic, and vertical mulcher treatments.

There was an important inverse association between the stalk weight and stalk population of cane in the experiment. Cane in the check plots and for plots following the deep parabolic subsoiling had higher average stalk weight but lower stalk population than cane following the shallow parabolic and vertical mulcher treatments. This yield component behavior was not reflected in tonnage and sugar yields, and no explanation for this behavior is obvious.

Drought conditions existed in June and July of 1995, when little rain fell during a five-week period. Subsoiled plots generally accumulate more moisture at deeper depths than plots not subsoiled. But subsoiled plots did not support better plant growth and development in spite of the possibility of having greater subsoil moisture.

Fig. 1 - Influence of Subsoil Treatment on the Pounds of Sugar/Acre

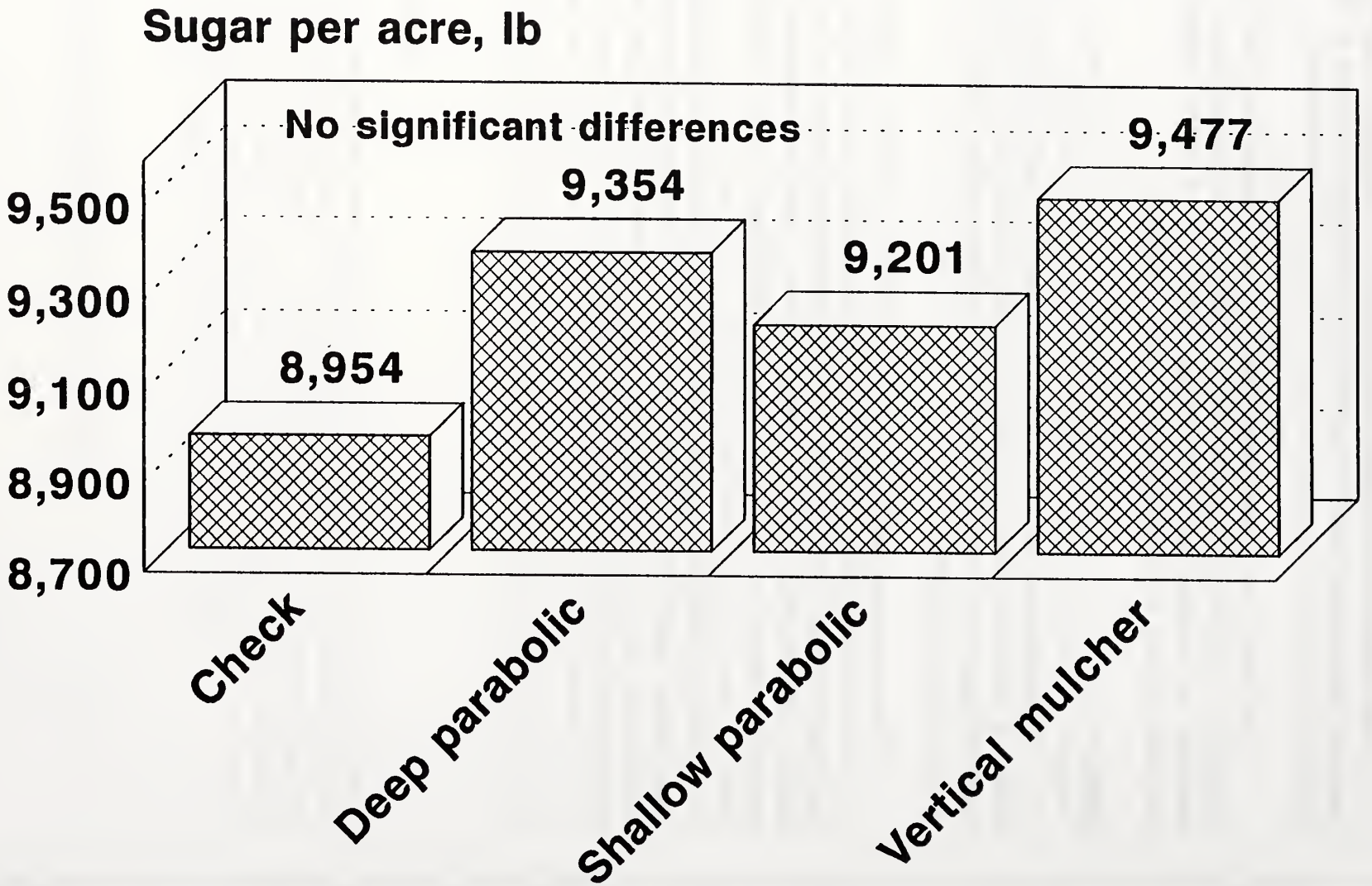
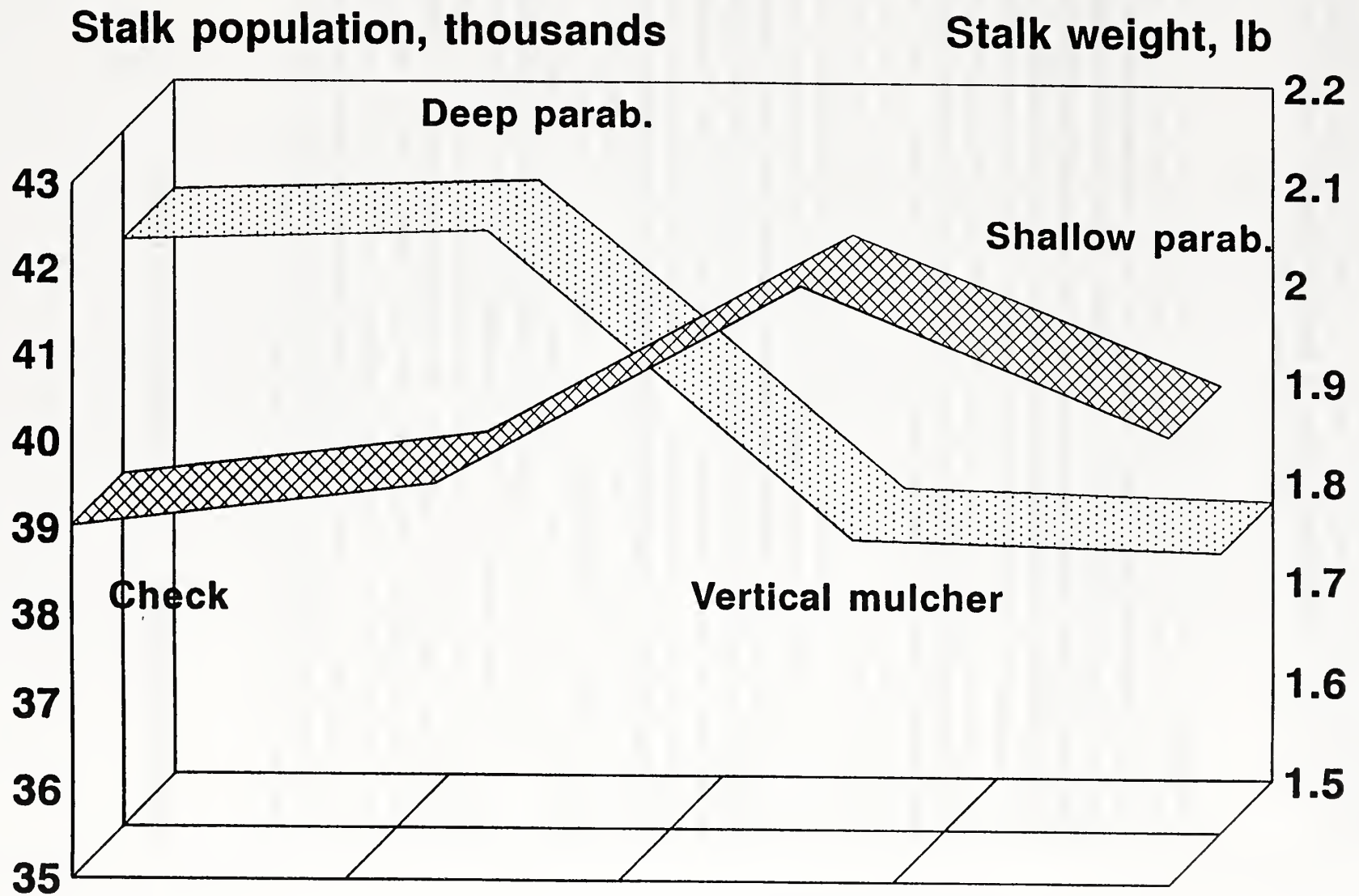


Fig. 2 - Relationship of Stalk Weight and Stalk Population for Subsoil Treatments



PLANTCANE RESPONSE TO FALLOW YEAR SOYBEANS

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LSU Agricultural Center

SUMMARY:

The relative nitrogen uptake by sugarcane from soybean residue and indigenous soil organic nitrogen is largely unknown. An experiment was conducted on a Coteau silt loam to determine sugarcane response to incorporated soybean residue and/or applied N fertilizer. Prior to spring fertilization mean soil nitrate contents following soybeans and fallow were 8.3 and 4.9 ppm, respectively, for the 1 ft. depth of sampling. At the late grand growth stage, highest nitrate levels were found in plots benefiting from both fertilizer and soybean residue (9.1 ppm) in the surface foot of soil. Sugar yields were indifferent to fallow year treatments and were not correlated to plant or soil nitrogen content.

INTRODUCTION:

Crop sequences involving legumes as a green manure crop in rotation with commodities are widely used in parts of the United States. Inclusion of a legume improves soil physical properties and increases soil N availability. Little is known of the N response of sugarcane cropped after soybeans. The amount of N mineralized from soybean residue for uptake has not been measured for different soil types. The objective of this study was to compare soybean residues and fallow as a source for sugarcane nutrition on a relatively low organic matter soil.

EXPERIMENTAL PROCEDURES:

The experiment was conducted on a Coteau silt loam low in P and K, with a relatively low organic matter content of 1.2%. Treatments were a conventional fallow and sugarcane rotation grown with 0 and 120 lb N per acre, and soybeans rotated with sugarcane with 0 and 120 lb N per acre applied to sugarcane. The experimental design was a randomized complete block with 5 replications. Plots were 3 rows, 70 ft. long and 68 in. wide. Soybean cultivar Dyna Gro 3495 (Group V maturity) and sugarcane variety CP 70-321 were planted on May 9, 1994 and September 21, 1994. Phosphorus and potassium fertilization and preemergence weed control were accomplished in a conventional manner according to recommended practices. Fertilizer (32% liquid N formulation) was applied on May 4, 1995.

Research was supported by the American Sugar Cane League

To determine the amounts of nitrate in soil profiles, duplicate soil samples for each plot were taken to a depth of 1 ft., in March 13, 1995, and October 26, 1995. Composite soil samples were prepared by thoroughly mixing the soil from duplicate cores from each plot. Soil was dried at 30 to 35 degrees C in a forced-draft dryer and ground to pass a 1-mm screen.

RESULTS:

Cane and sugar yields did not respond to higher soil and plant nitrogen associated with soybean residue. As can be observed in figure 1, the yield of sugar per acre was indifferent to the presence or absence of soybean residue and fertilizer. The average sugar yield of fertilized cane following fallow and green manure soybeans was 5,606 and 5,674 pounds of sugar per acre, respectively. The average sugar yield for cane that was not fertilized was 5,899 and 5,574 pounds of sugar per acre, respectively, for the fallow and green manure soybean treatments. There were no significant differences among the four treatment responses.

The failure of sugarcane to respond to additional amounts of soil nitrogen supplied by soybeans and fertilizer is graphically demonstrated in figure 2. No association was evident between soil nitrate levels and sugar yield ($r = -0.09$, $P = .84$), in spite of elevated levels of nitrates in the surface 1 foot of soil for plots receiving both soybean residue and fertilizer. In the spring prior to fertilization, soil nitrate levels were approximately twice as high for plots with soybean residue than for fallow plots (8.3 vs. 4.9 ppm in the surface foot). In the fall at late grand growth soil nitrate levels in the surface foot were 3.0, 4.2, 4.2, and 9.1 ppm, respectively, for the unfertilized fallow, fertilized fallow, unfertilized soybean, and fertilized soybean treatments.

Confusing the interpretation of data is the lack of association between nitrogen content on a whole plant basis and yield ($r = .31$, $P = .49$), between leaf nitrogen content and yield ($r = -0.12$, $P = .80$), and leaf nitrogen content and soil nitrate content ($r = -0.53$, $P = .22$). This is in spite of a significant correlation between nitrogen content on a whole plant basis and soil nitrate content ($r = .78$, $P = .04$).

Fig. 1 - Influence of Fallow-period Treatment on Plantcane Sugar Yield

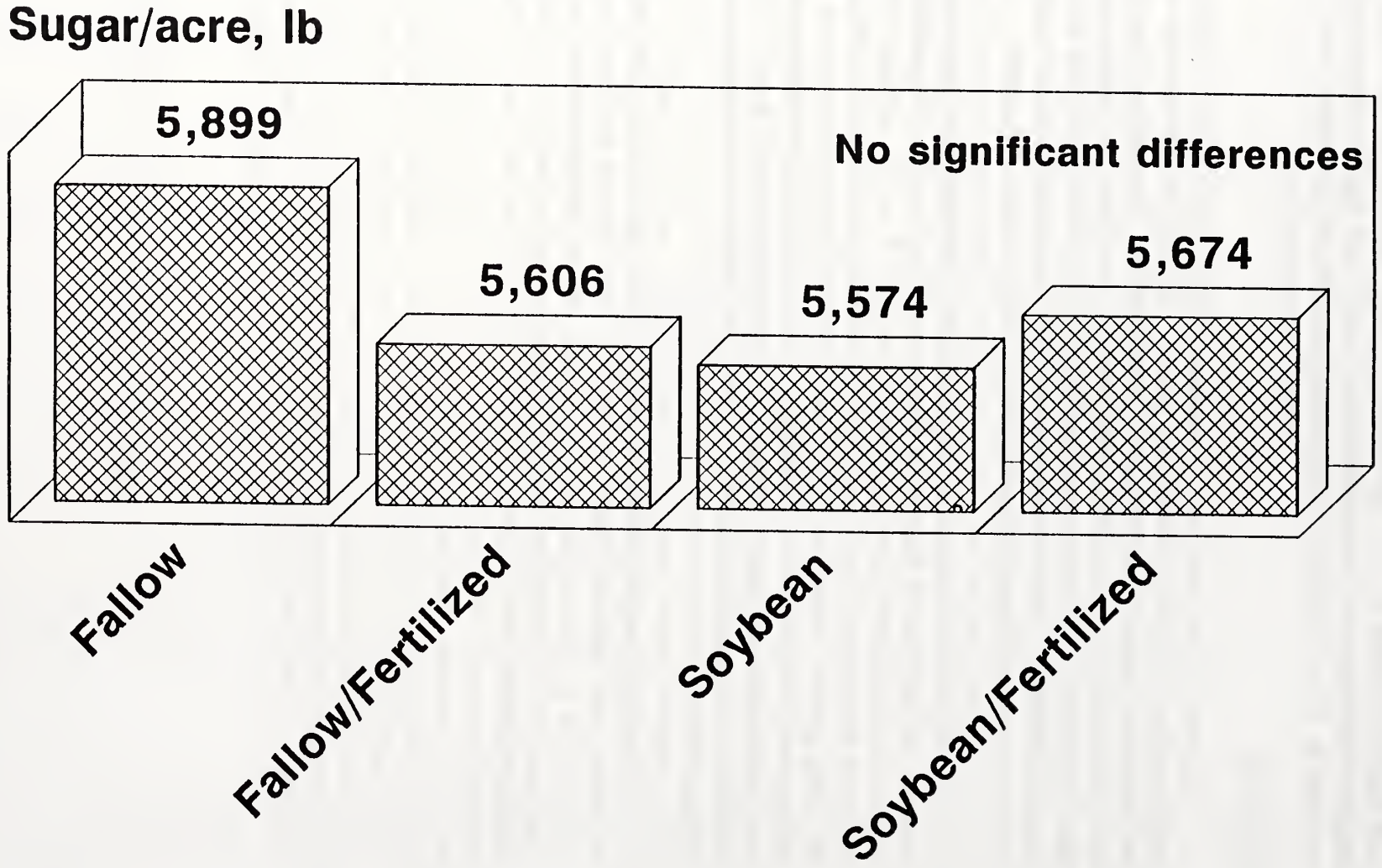
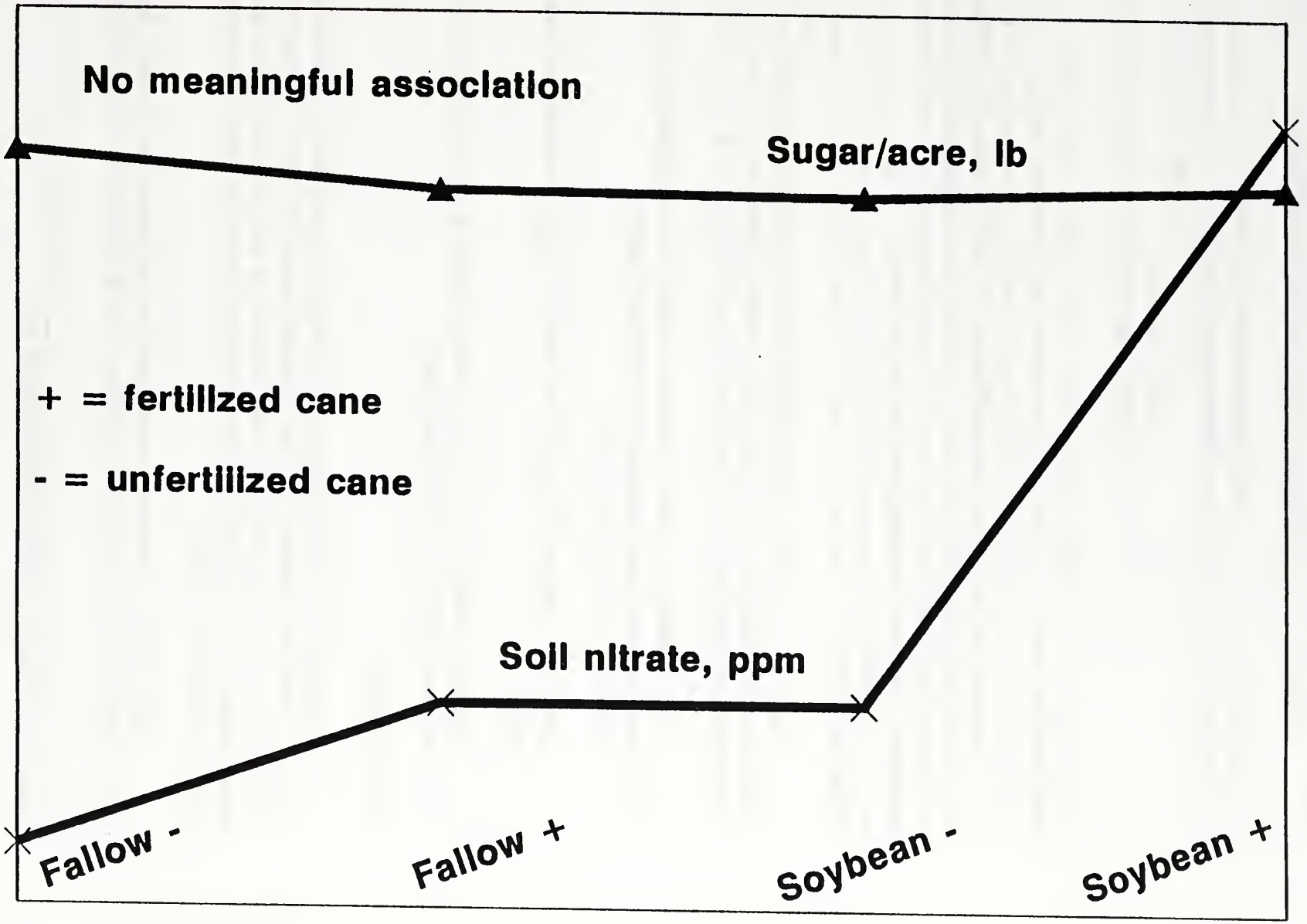


Fig. 2 - Association of Soil Nitrate and Sugar Yield



EFFECT OF UREA, AQUA AMMONIA, AND NITRO+ ON PLANT CANE YIELD PARAMETERS

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SUMMARY

Liquid Nitro+ (which contained 10% Ca as calcium chloride, plus a urease inhibitor) and liquid urea or aqua ammonia were tested for their effect on plant cane yield parameters. Results show that the liquid fertilizer treatments did not significantly ($P \leq 0.10$) affect stalk weight, plant population, CRS, cane tonnage, or sugar yield in 1995.

INTRODUCTION

Research at the Iberia Research Station showed that adding 40 lbs Ca/A (as N-hib Ca, which contained 12% Ca, 1.5% Mg, and a urease inhibitor) to 120 lbs N/A as liquid urea increased sugar yields (by 11.7%) and nitrogen use efficiency on a heavy textured soil.

Further research is needed to determine whether calcium chloride can increase sugarcane yields when used with aqua ammonia as the nitrogen source.

Objectives of our study were to:

1) Determine whether adding calcium chloride to aqua ammonia can increase sugarcane yields.

2) Determine whether liquid urea or aqua ammonia is the best source of N for use with calcium chloride in growing sugarcane.

PROCEDURES

In September 1994, a sugarcane liquid fertilizer study was initiated on a Baldwin silty clay soil at the Iberia Research Station. Kleentek variety CP70-321 was planted at three stalks and a lap of two joints. The experiment consisted of six treatments (Table 2) in a 6x6 Latin square design. Experimental plots were composed of three 5'10" by 46 foot rows with a 10 foot alley at the ends of the plots.

Liquid fertilizer treatments were applied to the inner off-bar in early May of 1995. A blanket application of dry P_2O_5 (polyphosphate), and K_2O (potassium chloride) was applied to the

Research was partially supported by Stoller Enterprises, Inc.

outer off-bar at 60 and 80 lbs/A, respectively. The fertilizer was then covered by "hipping up"the rows, and the cane was grown until harvest using standard cultural practices.

Plant populations were determined in September 1995. All plots were harvested in December and weighed with a weigh rig. A 10-stalk sample was taken at harvest from each plot to determine average stalk weight and juice quality.

RESULTS AND DISCUSSION

Table 1 shows that the liquid fertilizer treatments (Table 2) did not significantly ($P \leq 0.10$) affect any of the measured yield parameters for plant cane. However, there was a trend ($P \leq 0.25$) for the treatments to affect CRS and sugar yield. The CVs (%) were small for four of the five yield parameters (Table 1), which indicates that the Latin square design did a good job of removing variability from the test.

Table 2 shows that there was a trend ($P \leq 0.25$) for calcium to increase CRS when it was added to the 120 lbs N/A urea treatment (T #2 vs T #1). There was also a trend for CRS and sugar/A to be lower for T #6 vs T #5, which indicates that urea may be a better source of N than aqua ammonia.

Table 1. F-values for effect of urea, aqua ammonia, and calcium chloride fertilizer on plant cane yield parameters.

Variables	df	Millable stalk Wt.	Millable stalk No.	CRS	Cane yield	Sugar yield
Treatments	5	0.87	0.82	1.88°	0.72	1.50°
% CV		10.47	4.09	3.77	2.83	5.15
RMSE		0.1976	1048	7.881	0.9549	362.4
Avg.		1.886	25,658	209.1	33.70	7043

° denotes statistical significance at the P≤0.25 level.

Table 2. Effect of urea, aqua ammonia, and calcium chloride on plant cane yield parameters.

T#	Urea	Aqua ammonia	Calcium chloride	Millable stalk Wt.	Millable stalk No.	CRS	Cane Yield	Sugar Yield
	- - -lbs N/A- - -		lbs Ca/A	lbs	1000/A	lbs/T	T/A	lbs/A
1	120	-	0	1.86	25.7	209	34.0	7080
2	120	-	40	1.90	25.8	214	33.8	7220
3	-	120	40	1.99	25.1	212	33.7	7160
4	180	-	0	1.90	26.3	211	33.3	7020
5	180	-	60	1.92	25.4	208	34.1	7070
6	-	180	60	1.76	25.8	201	33.3	6700
LSD 0.10				NS	NS	NS	NS	NS
LSD 0.25				NS	NS	5+	NS	280+

NS denotes that the LSD value is not given because the indicated variable was not significant at the designated P value.
+ denotes the LSD 0.25 value at which the treatment means were statistically different.

EFFECT OF COMPOSTED MUNICIPAL WASTE ON SUGARCANE PRODUCTION AND FERTILIZER REQUIREMENTS FOR A HEAVY TEXTURED SOIL

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X. Wan, L.P. Brown, and G.L. Hawkins

Iberia Research Station, Agronomy Department,
and Audubon Sugar Institute

SUMMARY

A compost by fertilizer study across four years on a Baldwin silty clay soil showed that incorporating up to 100 T/A of compost into sugarcane rows before planting had no significant ($P \leq 0.10$) effect on sugar yields where the recommended rate of commercial fertilizer was used. However, where fertilizer was not applied, adding 100 T/A of compost increased sugar yields by 1190, 1000, and 1710 lbs/A in 1992, 1993, and 1994.

Our results suggest that incorporating compost into sugarcane rows is an effective means of "disposing" of compost, but would not be cost effective if sugarcane producers had to purchase the compost. Although the compost appeared to have some fertilizer value, it would be prohibitive to apply the large quantities needed to meet the nutrient needs of sugarcane.

INTRODUCTION

This research was funded by the Louisiana Educational Quality Support Fund (LEQSF) to determine if composted municipal waste can be effectively used in the production of sugarcane.

Objectives of the study were to:

1) Determine the effect of composted municipal waste on sugarcane yields when grown on a heavy textured soil.

2) Determine whether compost can be economically used to replace or supplement commercial fertilizer in the growing of sugarcane.

PROCEDURES

A sugarcane compost by fertilizer study was initiated in early October 1991 on a Baldwin silty clay soil (in the top 6" of soil P, K, Ca, Mg, and Na were 424, 150, 2573, 553,

Research was supported by the Louisiana Educational Quality Support Fund (LEQSF), Bedminster Bioconversion Corporation, American Sugar Cane League, Iberia Parish Council, City of New Iberia, Iberia Sugar Cooperative, Cajun Sugar Cooperative, Jeanerette Sugar Company, and M.A. Patout and Sons.

and 29 ppm, respectively; pH and % organic matter were 6.4 and 1.36) at the Iberia Research Station near Jeanerette. Compost rates (0, 20, 40, 60, 80, and 100 T/A, dry weight basis) were spread across rows from furrow-to-furrow (compost analysis for N, P, K, Ca, Mg, and Na were 1.10%, 0.65%, 0.53%, 2.07%, 0.22%, and 0.23%, respectively; pH and % organic matter were 7.3 and 39.0) and disked into the rows twice. The rows were then opened and planted in mid-October to Kleentek variety CP70-321 at three stalks and a lap of two joints.

The test used a randomized complete block design with three replications. Plots consisted of five 5'10" by 48 foot rows with 8 foot alleys at the ends of the plots, with a border row separating the plots. Fertilizer was applied (1.0x) to the inner off-bar of each row at 120, 60, 80, and 24 lbs/A of N, P_2O_5, K_2O, and S in April of 1992; and 160, 90, 120, and 24 lbs/A, respectively, of N, P_2O_5, K_2O, and S in April of 1993, 1994, and 1995. The rows were "hipped-up" to cover the fertilizer, and cane was grown to maturity using standard cultural practices.

The three center rows of each plot were harvested each fall and weighed with a weigh rig. A 10-stalk sample was taken at harvest to determine average stalk weight and juice quality for each plot.

RESULTS AND DISCUSSION

Of the five yield parameters measured (Table 1), only cane yield was affected ($P \leq 0.10$) by the main effect of compost application. The main effect of fertilizer was significant ($P \leq 0.10$) for CRS, cane yield, and sugar yield, while the CxF interaction was significant for CRS, cane yield, and sugar yield.

Harvest year affected all five yield parameters. The YxC interaction was significant ($P \leq 0.10$) for stalk weight; the YxF interaction was significant for stalk weight, plant population, CRS, and sugar yield; and the YxCxF interaction was significant for stalk weight, CRS, cane yield, and sugar yield.

Table 2 shows the interactive effect of year, compost, and fertilizer on cane stalk weights at harvest. Adding fertilizer to the 40 T/A compost rate (T #6 vs. T #5) increased stalk weights in 1992 and decreased stalk weights in 1993.

The interactive effect of year, compost, and fertilizer on CRS is shown in Table 4. Adding fertilizer to the 20 T/A compost treatment (T #4 vs T #3) increased ($P \leq 0.10$) CRS in 1993 and 1994, but did not affect CRS for any of the other years by compost combinations.

Tables 5 and 6 show the interactive effect of year, compost, and fertilizer on cane and sugar yields. Adding fertilizer increased cane tonnage (Table 5) in 1992 for the 0 T/A compost rate; in 1993 for the 0 and 20 T/A compost rates; in 1994 for the 0, 20, and 40 T/A compost rates; and in 1995 did not affect yields for any of the compost rates. Similar results were obtained with sugar yields (Table 6): adding fertilizer increased sugar yields in 1992 for the 0 T/A compost rate; in 1993 for the 0, 20, and 40 T/A compost rates; in 1994 for the 0, 20, 40, and 80 T/A compost rates; and in 1995 did not affect yields for any of the compost rates.

Adding 100T/A of compost in the absence of fertilizer increased cane yields by 6.5 and

8.8 T/A in 1992 and 1994, but had no significant effect in any of the four years where fertilizer was used (Table 5). Similar results were obtained with sugar yields (Table 6): adding 100T/A of compost where fertilizer was not used increased sugar by 1190, 1000, and 1710 lbs/A in 1992, 1993, and 1994, but had no significant effect where fertilizer was added.

Failure to obtain cane or sugar yield responses to fertilizer application in 1995 (Tables 5 and 6) was inconsistent with the yield responses obtained with fertilization in 1994 and previous years. Table 8 shows that all five yield parameters dropped precipitously from 1994 to 1995, even where fertilizer was not applied. This indicates that the cane may have deteriorated so much through disease infection that it was unable to respond to fertilizer. Another explanation is that nitrogen-fixing organisms may have built up in plants not receiving fertilizer and, thereby, satisfied their nitrogen needs. Evidence for this is provided by an assay conduction by Dr. Damaan which identified nitrogen-fixing bacteria in the plants that had not received fertilizer since the start of the study.

Table 8 shows the interactive effect of fertilizer rates and harvest year on stalk weight, plant population, CRS, and sugar yield. The % decrease for stalk weight, plant population, and sugar yield was greater from 1992 to 1995 where fertilizer was applied than where it wasn't applied.

Table 7 shows the interactive effect of compost rates and harvest year on stalk weight. Stalk weights in 1992 relative to 1995 were 0.546, 0.544, 0.618, 0.573, 0.485, and 0.530, respectively, for the 0, 20, 40, 60, 80, and 100 T/A compost rates. Consequently, the 40 T/A compost rate seemed to decrease the rate of decline in stalk weights with time.

Harvest year had an appreciable effect on all five yield parameters (Tables 1 and 11). Each of the variables dropped precipitously from 1994 to 1995 (Table 11).

The CxF interactions for CRS (Table 4), cane yield (Table 5), and sugar yield (Table 6) were all statistically ($P \leq 0.10$) significant (Table 1). The increase in CRS from adding fertilizer to the 20 T/A compost rate was statistically higher than for any of the other compost rates (Table 4). The larger increases in cane tonnage (Table 5) and sugar yields (Table 6) with fertilizer application at the lower compost rates indicates that the compost had fertilizer value.

Table 1. F-values for effect of compost, fertilizer, and harvest year on sugarcane yield parameters at Jeanerette.

Source	df	Stalk wt.	Plant pop.	CRS	Cane yield	Sugar yield
main-plots						
Compost (C)	5	0.43	1.53°	0.44	12.67*	1.90°
Fertilizer (F)	1	1.93°	0.00	4.47***	28.50****	42.86****
CxF	5	0.22	0.49	2.32■	2.17■	3.19*
sub-plots						
Year (Y)	3	223.20****	27.73****	203.05****	455.33****	577.64****
YxC	15	1.74■	0.64	1.46°	1.11	1.14
YxF	3	3.27*	5.45**	5.19**	32.19	37.92****
YxCxF	15	1.98*	0.90	1.60■	1.21■	2.33**
% CV for main-plots		12.10	12.91	5.38	13.55	14.71
% CV for sub-plots		9.61	9.25	3.93	5.68	6.76
RMSE for main-plots		0.2378	3892	10.15	3.944	821.0
RMSE for sub-plots		0.1890	2788	7.423	1.654	377.0
Avg.		1.966	30,146	188.8	29.11	5580

°, ■, *, **, ***, and **** denote statistical significance at the $P \leq 0.25$, 0.10, 0.05, 0.01, 0.001, and 0.0001 levels, respectively.

Table 2. Effect of fertilizer and compost on sugarcane stalk weights at Jeanerette across four years.

T#	Compost	Fert.	Harvest year 1992	1993	1994	1995	Avg.
	T/A		lbs/stalk				
1	0	0	2.27	2.07	1.76	1.40	1.88
2	0	1.0x	2.55	2.16	2.05	1.21	2.00
3	20	0	2.35	2.18	1.76	1.33	1.90
4	20	1.0x	2.47	2.26	1.97	1.30	2.00
5	40	0	2.07	2.38	1.89	1.44	1.95
6	40	1.0x	2.43	1.86	2.20	1.34	1.96
7	60	0	2.44	2.12	1.95	1.30	1.95
8	60	1.0x	2.23	2.34	1.99	1.38	1.99
9	80	0	2.39	2.43	2.16	1.11	2.02
10	80	1.0x	2.39	2.18	2.34	1.22	2.03
11	100	0	2.30	2.16	1.99	1.28	1.93
12	100	1.0x	2.34	2.33	2.14	1.18	2.00
LSD 0.10			0.33+	0.33+	0.33+	0.33+	NA

NA denotes that the LSD value is not given because the CxF interaction was not significant at $P \leq 0.10$.
+LSD 0.10 values for effect of compost and fertilizer rates on stalk weights within a given harvest year.

Table 3. Effect of fertilizer and compost on sugarcane plant populations at Jeanerette across four years.

			Harvest year				
T#	Compost	Fert.	1992	1993	1994	1995	Avg.
	T/A		----------1000/A----------				
1	0	0	31.4	30.3	29.8	27.4	29.7
2	0	1.0x	29.6	30.3	32.9	23.4	29.0
3	20	0	29.8	30.9	31.4	26.9	29.8
4	20	1.0x	29.2	31.0	34.2	24.7	29.8
5	40	0	29.8	29.6	30.0	26.4	29.0
6	40	1.0x	31.6	30.2	33.3	24.0	29.8
7	60	0	30.4	30.0	31.1	27.4	29.7
8	60	1.0x	32.5	29.1	33.7	24.7	30.0
9	80	0	33.0	31.1	32.6	28.7	31.4
10	80	1.0x	32.7	31.0	34.4	32.1	32.6
11	100	0	31.4	30.4	32.2	31.9	31.5
12	100	1.0x	32.6	29.4	33.4	23.0	29.6
LSD 0.10			NA	NA	NA	NA	NA

NA denotes that the LSD value is not given because the CxF and YxCxF interactions were not significant at $P \leq 0.10$.

Table 4. Effect of fertilizer and compost on sugarcane CRS at Jeanerette across four years.

			Harvest year				
T#	Compost	Fert.	1992	1993	1994	1995	Avg.
	T/A		lbs/T				
1	0	0	202	196	187	166	188
2	0	1.0x	213	205	197	159	193
3	20	0	200	188	175	156	180
4	20	1.0x	206	212	211	162	198
5	40	0	191	193	185	165	185
6	40	1.0x	198	203	198	162	190
7	60	0	204	195	195	165	190
8	60	1.0x	195	202	197	170	191
9	80	0	197	198	189	156	185
10	80	1.0x	196	207	207	161	193
11	100	0	198	200	189	162	187
12	100	1.0x	195	196	192	168	188
LSD 0.10			14+	14+	14+	14+	7≠

+LSD 0.10 values for effect of compost and fertilizer treatments on CRS within harvest years.

≠LSD 0.10 values for effect of compost and fertilizer treatments on CRS values averaged across harvest years.

Table 5. Effect of fertilizer and compost on cane tonnage at Jeanerette across four years.

			Harvest year				
T#	Compost	Fert.	1992	1993	1994	1995	Total
	T/A		T/A				
1	0	0	26.4	26.4	25.4	19.5	97.7
2	0	1.0x	33.7	33.4	38.2	20.6	125.9
3	20	0	26.8	26.7	27.0	19.5	100.0
4	20	1.0x	29.9	33.3	37.8	19.6	120.6
5	40	0	28.3	28.3	29.7	19.4	105.7
6	40	1.0x	32.6	32.9	37.0	19.9	122.4
7	60	0	31.0	30.7	31.9	21.7	115.3
8	60	1.0x	32.0	33.2	35.5	19.2	119.9
9	80	0	31.3	30.0	33.9	22.6	117.8
10	80	1.0x	33.9	33.7	38.6	21.6	127.8
11	100	0	32.9	30.8	34.2	22.1	120.0
12	100	1.0x	34.6	33.3	36.1	20.2	124.2
LSD 0.10			5.5+	5.5+	5.5+	5.5+	11.0∓

+ denotes the LSD 0.10 for effect of compost and fertilizer treatments on cane tonnage within an individual year.

∓ denotes the LSD value for the effect of compost and fertilizer treatments on total cane tonnage across harvest years.

Table 6. Effect of fertilizer and compost on sugar yield at Jeanerette across four years.

			Harvest year				
T#	Compost	Fert.	1992	1993	1994	1995	Total
	T/A		- - - - - - - - - - - - - - - lbs/A - - - - - - - - - - - - - - -				
1	0	0	5330	5180	4750	3250	18,510
2	0	1.0x	7200	6860	7510	3260	24,830
3	20	0	5370	5010	4700	3040	18,120
4	20	1.0x	6150	7080	8000	3160	24,390
5	40	0	5400	5470	5640	3220	19,730
6	40	1.0x	6450	6660	7320	3200	23,630
7	60	0	6290	5990	6210	3580	22,070
8	60	1.0x	6230	6690	7000	3290	23,210
9	80	0	6160	5930	6390	3520	22,000
10	80	1.0x	6640	6980	7980	3490	25,090
11	100	0	6520	6180	6460	3590	22,750
12	100	1.0x	6750	6520	6910	3370	23,550
LSD 0.10			1150+	1150+	1150+	1150+	2300∓

+ LSD 0.10 values for effect of compost and fertilizer rates on sugar yields within a given harvest year.

∓ LSD 0.10 value for effect of compost and fertilizer rates on total sugar yields across years.

Table 7. Effect of compost rates and harvest years on sugarcane yield parameters at Jeanerette.

Compost rates	Harvest year	Millable stalk Wt.	Millable stalk No.	CRS	Cane yield	Sugar yield
T/A		lbs	1000/A	lbs/T	T/A	lbs/A
0	1992	2.41	30.5	207	30.1	6260
0	1993	2.12	30.3	201	29.9	6020
0	1994	1.91	31.3	192	31.8	6130
0	1995	1.31	25.4	162	20.1	3250
20	1992	2.41	29.5	203	28.4	5760
20	1993	2.22	31.0	200	30.0	6040
20	1994	1.86	32.8	193	32.4	6350
20	1995	1.31	25.8	159	19.5	3100
40	1992	2.25	30.7	194	30.4	5920
40	1993	2.12	29.9	198	30.6	6060
40	1994	2.05	31.6	194	33.3	6480
40	1995	1.39	25.2	164	19.7	3210
60	1992	2.34	31.5	199	31.4	6260
60	1993	2.23	29.5	199	31.9	6340
60	1994	1.97	32.4	196	36.2	6610
60	1995	1.34	26.0	168	22.1	3430
80	1992	2.39	32.9	196	32.6	6400
80	1993	2.31	31.1	202	31.4	6450
80	1994	2.25	33.5	198	36.2	7190
80	1995	1.16	30.4	159	22.1	3500
100	1992	2.32	32.0	196	33.8	6630
100	1993	2.24	29.9	198	32.1	6350
100	1994	2.07	32.8	190	35.2	6690
100	1995	1.23	27.4	165	21.2	3480
LSD 0.10		0.24+	NA	NA	NA	NA
LSD 0.10		0.18±	NA	NA	NA	NA

NA denotes that the LSD value is not given because the YxC interaction was not significant at $P \leq 0.10$.
+ LSD value for effect of compost rates within a given harvest year.
± LSD value for effect of harvest years within a given compost rate.

Table 8. Effect of fertilizer rates and harvest years on sugarcane yield parameters at Jeanerette.

Fertilizer rates	Harvest year	Millable stalk Wt.	Millable stalk No.	CRS	Cane yield	Sugar yield
		lbs	1000/A	lbs/T	T/A	lbs/A
0	1992	2.30	31.0	198	29.5	5840
0	1993	2.22	30.4	195	28.8	5630
0	1994	1.92	31.2	187	30.3	5690
0	1995	1.31	28.1	162	20.8	3370
1.0x	1992	2.40	31.4	200	32.8	6570
1.0x	1993	2.19	30.2	204	33.3	6800
1.0x	1994	2.12	33.6	200	37.2	7450
1.0x	1995	1.27	25.3	164	20.2	3290
LSD 0.10		0.14+	2.2+	6+	2.2+	470+
LSD 0.10		0.11±	1.5±	4±	0.9±	210±

+ LSD 0.10 values for effect of fertilizer rates on the indicated yield parameter within a given harvest year.
± LSD 0.10 values for effect of harvest year on the indicated yield parameter within a given fertilizer rate.

Table 9. Main effect of compost rates on sugarcane yield parameters at Jeanerette.

Compost rates	Millable Stalk Wt.	Millable Stalk No.	CRS	Cane yield	Sugar yield
T/A	lbs	1000/A	lbs/T	T/A	lbs/A
0	1.94	29.4	190	28.0	5420
20	1.95	29.8	189	27.6	5310
40	1.95	29.4	187	28.5	5420
60	1.97	29.9	190	29.4	5660
80	2.03	32.0	189	30.7	5890
100	1.96	30.5	187	30.5	5790
LSD 0.10	NS	NS	NS	2.0+	NS

NS denotes that the main effect was not statistically significant ($P \leq 0.10$) for the indicted yield parameter.
+ denotes the LSD 0.10 value at which the main effect was significant for the indicated variable.

Table 10. Main effect of compost rates on sugarcane yield parameters.

Fertilizer rates	Millable stalk Wt.	Millable stalk No.	CRS	Cane yield	Sugar yield
	lbs	1000/A	lbs/T	T/A	lbs/A
0	1.94	30.2	186	27.4	5130
1.0x	1.99	30.1	192	30.9	6030
LSD 0.10	NS	NS	3+	1.1+	230

NS denotes that the main effect was not statistically significant ($P \leq 0.10$) for the indicated yield parameters.
+ denotes the LSD 0.10 value at which the main effect was significant for the indicated variable.

Table 11. Main effect of harvest year on sugarcane yield parameters.

Harvest year	Millable stalk Wt.	Millable stalk No.	CRS	Cane yield	Sugar yield
	lbs	1000/A	lbs/T	T/A	lbs/A
1992	2.35	31.2	199	31.1	6210
1993	2.21	30.3	200	31.1	6210
1994	2.02	32.4	194	33.8	6570
1995	1.29	26.7	163	20.5	3330
LSD 0.10	0.07+	1.1+	3+	0.6+	150+

+ LSD 0.10 value for main effect of harvest year on the indicated yield parameters.

EFFECT OF UREA SOURCES AND NITROGEN RATES ON FIRST-STUBBLE YIELD PARAMETERS

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SUMMARY

Our study was conducted to determine the effect of a nitrification inhibitor (Super U, supplied by IMC Global Operations Inc.) on first stubble sugarcane yield responses to urea fertilizer when grown on an Iberia clay soil. Results show that 120 lbs N/A as super urea (which contained the nitrification inhibitor) produced significantly ($P \leq 0.10$) more cane and sugar yield than 120 lbs N/A as urea, and yielded statistically equal to 180 lbs N/A as urea. This suggests that Super U improved nitrogen use efficiency for first-stubble cane.

INTRODUCTION

Loss of nitrogen from sugarcane fields during the growing season can result in reduced sugarcane yields. Consequently, nitrification inhibitors are sometimes added to urea and ammonium based nitrogen fertilizers to slow the rate at which nitrate is produced. This can result in less nitrogen loss from leaching and denitrification after heavy rainfall, which could result in increased sugarcane yields.

Objectives of our study were to:

1) Determine the effect of urea nitrogen rates on sugarcane yields.

2) Determine whether the use of Super U can increase sugarcane yields when using various urea nitrogen rates.

PROCEDURES

In April 1995, a urea source by nitrogen rate study was continued with first-stubble cane on an Iberia clay soil in St. Mary Parish using CP 72-370 cane. Initial soil analysis showed 152, 346, 7148, and 831 ppm, respectively for P, K, Ca, and Mg; soil pH was 7.2. The experiment was replicated seven times in a 7 by 7 Latin square design. Plots consisted of three 5'10" by 50 foot rows, with 8 foot alleys separating the plots. Fertilizer rates (Table 1) for urea and super-urea (which contained the nitrification inhibitor) were applied with a blanket application of P (90 lbs P_2O_5/A as polyphosphate), K (120 lbs/A of K_2O as KCl), and S (24 lbs S/A as gypsum) to the inside off-bar of each row in late April of 1994). The rows were "hipped-up" to cover the fertilizer, and cane was grown to maturity using standard cultural practices.

In September 1995, sugarcane stalks from all plots were counted to determine the effect

of treatments on plant populations. The plots were harvested in late November and weighed with a weigh rig. A 10-stalk sample was taken from each plot to determine average stalk weight and juice quality.

RESULTS AND DISCUSSION

The effect of urea sources and nitrogen rates on the analysis of variance for first stubble yield parameters is given in Table 1. Fertilizer treatments significantly ($P \leq 0.10$) affected plant population, cane yield, and sugar yield, but had no effect on stalk weight and CRS. The CVs (%) were below 10 for all the parameters, except stalk weight.

Table 2 shows that both urea and super urea significantly ($P \leq 0.10$) increased plant population, and cane and sugar yield. Super urea produced its highest cane and sugar yields at 120 lbs N/A, while urea gave its highest yield at 180 lbs N/A. The 120 lbs N/A super urea treatment yielded numerically higher than the 180 lbs N/A urea treatment. These results indicate that the nitrification inhibitor (Super U) did indeed improve nitrogen use efficiency.

Table 1. F-values for effect of urea rates and sources on first-stubble sugarcane yield parameters.

		Millable Stalk			Cane	Sugar
Source	df	Wt.	No.	CRS	yield	yield
Treatments	6	0.84	7.38****	0.64	10.31****	9.65****
% CV		11.20	5.85	2.58	8.59	9.25
RMSE		0.1931	1571	5.405	2.585	582.7
Avg.		1.725	26,865	209.3	30.08	6298

**** denotes statistical significance at the $P \leq 0.0001$ level. Remaining F-values were non significant at $P \leq 0.25$.

Table 2. Effect of urea sources and rates on first-stubble yield parameters.

			Millable Stalk			Cane	Sugar
T#	N-rate	Source	Wt.	No.	CRS	yield	yield
	lbs/A		lbs	1000/A	lbs/T	T/A	lbs/A
1	0	Check	1.60	23.7	207	23.7	4900
2	60	Urea	1.72	26.2	210	29.1	6110
3	120	Urea	1.79	27.0	208	30.0	6230
4	180	Urea	1.74	28.3	209	32.4	6790
5	60	Super urea	1.77	27.2	212	31.2	6620
6	120	Super urea	1.78	27.1	209	33.3	6960
7	180	Super urea	1.68	28.6	211	30.8	6480
LSD 0.10			NS	1.4+	NS	2.3+	530+
LSD 0.25			NS	1.0±	NS	1.6±	370±

NS denotes that the fertilizer treatments did not have a statistically significant effect on the yield parameter at the indicated P level.

+ denotes the LSD 0.10 value at which the indicated treatment means were significantly different.

± denotes the LSD 0.25 value at which the indicated treatment means were significantly different.

EFFECT OF CALCITIC LIME ON SUGARCANE YIELD PARAMETERS

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SUMMARY

A sugarcane lime study compared various rates of Domino by-product lime to commercial lime in their effects on soil parameters and yield response of plant cane. Results indicate that the Domino lime was more soluble than the commercial lime and, therefore, resulted in quicker changes in soil pH, Ca, and CEC. However, none of the lime treatments significantly affected plant cane yields in 1995.

INTRODUCTION

While some lime research with sugarcane has been done in Louisiana, additional research is needed to keep current with the new varieties that have been released in recent years.

Objectives of our study were to determine the effect of Domino by-product lime and commercial lime on soil pH and nutrient parameters, and on sugarcane yield parameters.

PROCEDURES

In August of 1994, a calcitic lime study was initiated on Hebert Farms in Jeanerette on a Baldwin silty clay loam soil. The experimental design was a 6x6 Latin square. Experimental plots consisted of three 5'10" by 50 foot sugarcane rows with 10 foot alleys separating the ends of the plots.

The six treatments in the study were: 1) check, where lime was not added; 2) 2.00 T/A of commercial lime; 3) 0.75 T/A Domino lime; 4) 1.50 T/A Domino lime; 5) 2.25 T/A Domino lime; and 6) 3.00 T/A Domino lime. The lime treatments were added on top of sugarcane rows on August 23, 1994. Next day the sugarcane rows were opened for planting with second progeny Kleentek variety LCP82-89 at three stalks and a lap of two joints. The rows were then covered to germinate the sugarcane.

On April 27, 1995 dry N, P_2O_5, K_2O, and S were added in the off-bar at 20, 24, 180, and 12 lbs/A, respectively. Also, 124 lbs N/A as liquid URAN was spiked into the sides of the rows. The cane was grown to maturity using standard cultural practices.

Research was supported by a grant from Domino Sugar Corporation.

In late July 1995 soil samples (to a 6" depth) were taken (leaf tissue was also analyzed for nutrients) from the sides of the center row in each plot and analyzed for pH, P, Na, K, Mg, Ca, and CEC. In September 1995, plant populations were determined. The test was harvested on November 28, 1995. Plots were weighed with a weigh rig and a 10-stalk sample was taken to determine stalk weight and CRS.

RESULTS AND DISCUSSION

Tables 1 and 2 show that the lime treatments applied in August 1994 significantly affected the soil pH, Ca, and CEC in the top 6" of soil in the test plots in late July 1995. A soil pH of 4.30 for the check treatment (Table 2) shows that untreated soil was very low in pH. The Domino lime progressively increased soil pH with each additional increment of lime application. In fact, the 1.5 T/A application rate of Domino lime resulted in an equivalent soil pH as the 2.0 T/A rate of commercial lime, while the 2.25 and 3.00 T/A rates of Domino lime resulted in higher ($P \leq 0.10$) soil pH than the 2.0 T/A commercial lime rate.

The effect of the lime rates on soil pH was further reflected in the effect on soil Ca and CEC. Once again the 1.50 T/A rate of Domino lime resulted in an equivalent soil Ca and CEC as that for the 2.00 T/A commercial lime, while the 2.25 and 3.0 T/A Domino lime rates resulted in significantly ($P \leq 0.10$) higher soil Ca and CEC (Table 2).

Tables 3 and 4 show that the lime treatments did not significantly ($P \leq 0.10$) affect the plant population, CRS, cane yield, and sugar yield of plant cane in 1995. The 2.0 T/A commercial lime rate did, however, result in heavier stalk weights than all the other treatments, except for the 0.75 T/A Domino rate.

Table 1. F-values for effect of calcitic lime on selected soil parameters in 1995.

		Soil parameters						
Source	df	pH	P	Na	K	Mg	Ca	CEC
Treatments	5	24.37****	0.98	1.09	1.25	1.78°	49.01****	31.91****
% CV		1.98	13.13	11.40	10.58	4.41	4.49	3.82
RMSE		0.08913	17.73	3.928	40.10	37.68	165.1	1.012
Avg.		4.50	135.1	34.44	379.0	853.7	3680	26.51

°, and **** denote statistical significance at the P≤0.25 and 0.0001 levels, respectively.

Table 2. Effect of calcitic lime on soil parameters in 1995.

	Soil parameters						
Treatments	pH	P	Na	K	Mg	Ca	CEC
		- - - - - - - - ppm - - - - - - - -					meq/100g
1) check	4.30	139	35	392	865	3127	23.9
2) 2.00 T/A commercial lime	4.47	127	36	360	884	3620	26.4
3) 0.75 T/A Domino lime	4.37	136	32	389	836	3325	24.6
4) 1.50 T/A Domino lime	4.45	127	37	362	863	3645	26.4
5) 2.25 T/A Domino lime	4.60	138	33	369	830	3890	27.4
6) 3.00 T/A Domino lime	4.80	145	35	404	845	4475	30.5
LSD 0.10	0.09	NS+	NS	NS	NS	165	1.0

+Denotes that the lime treatments did not significantly affect these parameters at the P≤0.10 level.

Table 3. F-values for effect of calcitic lime on yield parameters of plant cane.

Source	df	Stalk weight	Plant population	CRS	Cane yield	Sugar yield
Treatments	5	3.50*	1.61°	0.75	0.92	0.79
% CV		10.61	5.27	2.13	15.80	16.08
RMSE		0.1887	1895	4.905	4.693	1101
Avg.		1.78	35,931	230	29.70	6848

° and * denote statistical significance at the $P \leq 0.25$ and 0.05 levels, respectively.

Table 4. Effect of calcitic lime on plant cane yield parameters.

Treatments	Stalk weight	Plant population	CRS	Cane yield	Sugar yield
	lbs	1000/A	lbs/T	T/A	lbs/A
1) Check	1.77	37.6	229	30.9	7080
2) 2.00 T/A commercial lime	2.01	35.3	231	29.0	6710
3) 0.75 T/A Domino lime	1.86	35.8	230	30.2	6930
4) 1.50 T/A Domino lime	1.65	35.1	233	26.5	6170
5) 2.25 T/A Domino lime	1.73	35.2	230	30.3	6950
6) 3.00 T/A Domino lime	1.68	36.6	231	31.6	7310
LSD 0.10	0.20	NS	NS	NS	NS
LSD 0.25	0.13	1.3	NS	NS	NS

EFFECT OF CALCIUM SOURCES ON PLANT CANE YIELD PARAMETERS

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SUMMARY

Eight different sources and methods of calcium placement were tested for their effects on plant cane yield parameters. Results in 1995 show that there was no significant ($P \leq 0.10$) effect of the calcium treatments on stalk weight, CRS, tonnage, and sugar yield.

INTRODUCTION

Sugarcane research in Louisiana shows that application of high amounts of calcium as gypsum (5-10 T/A) can result in significant (12%) yield responses in stubble crops. There is also a school of thought that says that optimum crop yields cannot be obtained unless the Ca/Mg ratio of soil (based on % CEC) is close to 7.0 for heavy textured soils. We conducted our study to test this theory.

PROCEDURES

In early September 1994, a sugarcane calcium source study was initiated on a Loreauville silt loam soil (soil analysis in March, 1994 showed 19, 105, 2000, 511, 4, 1.2 and 1.8 ppm, respectively, for P, K, Ca, Mg, S, B, and Zn; a soil pH of 6.4, and CEC of 16.0; and % cation saturation of 1.7, 62.5, 26.6, 9.0, and 0 for K, Ca, Mg, H, and Na, respectively) at the Judice Brothers Farm near Loreauville in Iberia Parish. The 2.35 base ratio for Ca/Mg was far below the 7.0 ratio that is considered ideal for heavy textured soils and, therefore, made the experiment an excellent site to test the Ca/Mg ratio theory.

First progeny Kleentek variety LHo 83-153 was planted at two stalks and a lap of two joints. The experiment consisted of eight treatments in an 8x8 Latin square design.

All treatments were applied two weeks after planting. The treatments were: 1) a check where nothing was applied; 2) 1.0 T/A of Domino by-product lime applied to the sides of the sugarcane rows; 3) 1.0 T/A of commercial lime applied to the sides of sugarcane rows; 4) 1.0 T/A of commercial lime applied to the tops of sugarcane rows; 5) 1.0 T/A of gypsum applied to the tops of sugarcane rows; 6) 0.55 T/A of granulated lime

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applied to the sides of rows; 7) 1.0 T/A of gypsum applied to sides of rows; and 8) 160 lbs/A of Ca as $Ca(Cl)_2$ applied to sides of rows. All experimental plots consisted of three 5'10" by 50 foot rows separated at their ends by a 10 foot alley and a 20 foot buffer area of check cane where Ca was not applied. All treatment plots were also separated by three 5'10" buffer rows on both sides of the plot.

Initial soil analyses showed a pH of 6.3 and %OM of 1.38; P, Na, K, Mg, and Ca were 115, 46, 138, 592, and 2788 ppm, respectively, and CEC was 19.3. The cane was fertilized with 100 lbs N/A as URAN, 15 lbs N/A and 45 lbs P_2O_5/A as DAP, and 90 lbs K_2O/A as KCl in April of 1995. The cane was grown to maturity using standard cultural practices for plant cane.

RESULTS AND DISCUSSION

Table 1 shows the effect of the calcium sources on F-values for plant cane for 1995. The experimental treatments did not significantly ($P \leq 0.10$) affect any of the measured yield parameters. However, Tables 2-5 show that CRS, tonnage, and sugar yield were about what would be expected for plant cane. Table 2 shows that the stalk weights were low, but this is characteristic of the variety grown.

The low CVs for cane and sugar yield (Table 1) show that there was little variability in the test that could not be explained by the treatments or experimental design. This bodes well for statistical analyses of the stubble crops where yield responses to soil inputs are usually manifested.

Table 1. F-values for effect of calcium sources and placement on plant cane yield parameters at the Judice Brothers farm near Loreauville.

Source	df	Stalk weight	CRS	Cane yield	Sugar yield
H Rep	7	1.86°	1.09	0.76	0.99
V Rep	7	3.30**	4.92***	3.52**	5.34***
Treatments	7	0.25	0.32	0.49	0.42
% CV		10.30	4.48	4.18	6.68
RMSE		0.1646	9.424	1.418	476.5

°, **, and *** denote statistical significance at the $P \leq 0.25$, 0.01, and 0.001 levels, respectively. Remaining F-values were nonsignificant at $P \leq 0.25$.

Table 2. Effect of calcium sources and placement on plant cane stalk weights in 1995.

Treatments		Stalk weight
		lbs/stalk
1)	Check	1.54
2)	1.0 T/A of Domino lime applied to sides of rows	1.62
3)	1.0 T/A of commercial lime applied to sides of rows	1.63
4)	1.0 T/A of commercial lime applied to tops of rows	1.62
5)	1.0 T/A of gypsum applied to tops of rows	1.59
6)	0.55 T/A of granulated lime applied to sides of rows	1.61
7)	1.0 T/A of gypsum applied to sides of rows	1.61
8)	160 lbs/A of Ca as $Ca(Cl)_2$ applied to sides of rows	1.58
LSD 0.10		NS

NS denotes that treatments did not affect stalk weights at the $P \leq 0.10$ level.

Table 3. Effect of calcium sources and placement on plant cane CRS in 1995.

Treatments		CRS
		lbs/T
1)	Check	210
2)	1.0 T/A of Domino lime applied to sides of rows	209
3)	1.0 T/A of commercial lime applied to sides of rows	209
4)	1.0 T/A of commercial lime applied to tops of rows	209
5)	1.0 T/A of gypsum applied to tops of rows	210
6)	0.55 T/A of granulated lime applied to sides of rows	215
7)	1.0 T/A of gypsum applied to sides of rows	210
8)	160 lbs/A of Ca as $Ca(Cl)_2$ applied to sides of rows	210
LSD 0.10		NS

NS denotes that treatments did not affect CRS at the $P \leq 0.10$ level.

Table 4. Effect of calcium sources and placement on plant cane tonnage in 1995.

Treatments		Cane yield
		T/A
1)	Check	34.0
2)	1.0 T/A of Domino lime applied to sides of rows	33.6
3)	1.0 T/A of commercial lime applied to sides of rows	33.6
4)	1.0 T/A of commercial lime applied to tops of rows	33.5
5)	1.0 T/A of gypsum applied to tops of rows	34.0
6)	0.55 T/A of granulated lime applied to sides of rows	33.9
7)	1.0 T/A of gypsum applied to sides of rows	34.4
8)	160 lbs/A of Ca as $Ca(Cl)_2$ applied to sides of rows	34.4
LSD 0.10		NS

NS denotes that treatments did not affect cane tonnage at the $P \leq 0.10$ level.

Table 5. Effect of calcium sources and placement on plant cane sugar yields in 1995.

Treatments		Sugar yield
		lbs/A
1)	Check	7150
2)	1.0 T/A of Domino lime applied to sides of rows	7030
3)	1.0 T/A of commercial lime applied to sides of rows	7020
4)	1.0 T/A of commercial lime applied to tops of rows	7000
5)	1.0 T/A of gypsum applied to tops of rows	7160
6)	0.55 T/A of granulated lime applied to sides of rows	7280
7)	1.0 T/A of gypsum applied to sides of rows	7230
8)	160 lbs/A of Ca as $Ca(Cl)_2$ applied to sides of rows	7240
LSD 0.10		NS

NS denotes that treatments did not affect sugar yields at the $P \leq 0.10$ level.

EFFECT OF LIQUID UREA AND N-HIB CALCIUM ON SUGARCANE YIELD PARAMETERS

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Summary:

The effects of liquid urea (0, 60, 120, and 180 lbs N/A) and liquid N-hib Ca (0, 20, and 40 lbs Ca/A supplied by Stoller Enterprises, Inc.) were tested, separately and in all possible combinations, on sugarcane yield parameters in a four-year (1991-1994) study.

Results showed that adding 40 lbs Ca/A as liquid N-hib Ca to 120 lbs N/A of liquid urea increased sugar/A yields across the four years by 2,630 lbs/A (150, 1090, 740, and 650 lbs/A, respectively, for 1991, 1992, 1993, and 1994). This increase in sugar resulted from increased stalk weights and tonnage from the application of calcium. This compares with a 2,010 lbs/A sugar increase from increasing nitrogen from 120 to 180 lbs N/A across the four years where calcium was not used. Consequently, adding N-hib Ca to liquid urea reduced the need for nitrogen fertilizer and should, therefore, reduce environmental degradation resulting from nitrogen fertilization.

Also, at $0.21/lb of sugar, the 2630 lbs/A of additional sugar across the four years caused by adding 40 lbs Ca/A each year increased the gross crop value by $552.30. It should therefore, be profitable for producers to use N-hib Ca in their liquid nitrogen fertilization program if it is priced sufficiently low.

Introduction:

Sugarcane production in Louisiana is limited by the relatively rapid deterioration in stubble crop yields. This results in the expensive practice of replanting every third or fourth year. Stubble crops also require higher fertilizer rates than plant cane, while producing less cane per acre.

The decrease in cane yields and increased fertilizer needs of stubble crops are thought to be related to the deterioration of the sugarcane root system. Consequently, if cultural practices could be identified that reduce, or delay, the deterioration of sugarcane roots, it should be possible to increase fertilizer use efficiency and yields.

Research with other crops indicates that adding N-hib Ca to liquid urea in a soil fertilization program can increase yields. To date, however, the effects of N-hib Ca have not been determined on sugarcane yields.

Research was partially supported by Stoller Enterprises, Inc.

Objectives of our study were to:

1) Determine whether N-hib Ca can increase sugarcane yields.
2) Determine whether N-hib Ca can reduce the N fertilizer requirements of sugarcane.

Procedures

In October of 1990, a urea x N-hib Ca soil fertility study (using liquid fertilizer) was initiated at the Iberia Research Station on a Baldwin silty clay soil. Initial soil analyses showed 279, 36, 281, 3396, and 668 ppm, respectively, for P, Na, K, Ca, and Mg; soil pH was 5.2. The experiment consisted of the 12 treatments given in Table 2, replicated three times in a randomized complete block design. Experimental plots consisted of three 5'10" by 48 foot rows, separated by 8 foot alleys at the ends of the plots.

In late October of 1990, the sugarcane rows were opened, and second progeny Kleentek variety CP65-357 was planted at three stalks and a lap of two joints. The rows were then closed to allow the sugarcane to germinate.

In late April or early May of 1991, 1992, 1993, and 1994, a liquid fertilizer solution containing urea and (or) N-hib Ca was added to the inner-offbar of each row in the study at the N and Ca rates given in Table 2. Phosphorus, K, and S were blanket applied to the outer-offbar of all rows at 90 lbs $P_2 0_5$/A (as polyphosphate), 120 lbs $K_2 0$/A (as K Cl), and 24 lbs S/A (as gypsum). The rows were "hipped-up" to cover the fertilizer in the off-bar, and the cane was grown until harvest using standard cultural practices.

In September of 1991, 1993, and 1994 sugarcane stalks in all plots were counted to determine the effects of the treatments on plant population. The plots were harvested each of the four years and weighed with a weigh rig. A 10-stalk sample was taken from each plot to determine average stalk weight and commercially recoverable sugar (CRS) per ton of harvested cane.

Statistical analyses were performed by SAS using the 12 N x Ca fertilizer treatments (FTs) as main plots and years as sub-plots. Protected LSD values were calculated and applied for main plots and sub-plots.

Results and Discussion:

Table 1 shows that the urea and N-hib Ca fertilizer treatments significantly ($P \leq 0.10$) affected stalk weights, plant populations, cane tonnage, and sugar yields, but had no effect on CRS. Harvest year affected all five of the measured variables, and the Y x FT interaction was not significant for any of the yield parameters.

Table 2 shows that the stalk weights averaged across years decreased from 1991 to 1992, remained stable in 1993, and decreased again in 1994. Treatment averages across years showed that calcium (40 lbs Ca/A) increased ($P \leq 0.10$) stalk weights (T #9 vs T#7) only at the 120 lbs N/A fertilizer rate.

Table 3 shows that nitrogen fertilization increased ($P \leq 0.10$) average plant population across the three years (T #'s 4, 5, and 6 vs. T #'s 1, 2, and 3), but calcium did not.

Table 4 shows that the fertilizer treatments did not significantly ($P \leq 0.10$) affect CRS values averaged across years. However, harvest year did affect CRS when averaged across fertilizer treatments.

Table 5 shows the effect of fertilizer treatments and harvest years on cane tonnage. Average tonnage across treatments decreased from 1991 to 1992, increased from 1992 to 1993, and decreased from 1993 to 1994. Comparison of T #9 with T #7 shows that adding 40 lbs Ca/A to 120 lbs N/A as liquid urea increased total cane tonnage across four years by 12.2 T/A. Increasing N from 120 to 180 lbs/A in the absence of calcium increased (T #10 vs. T #7) total tonnage by 12.8 T/A. Treatment #'s 9 and 10 did not differ significantly ($P \leq 0.10$), which shows that using 40 lbs Ca/A (T #'s 9 vs. 7) increased total cane tonnage as much as when N was increased from 120 to 180 lbs N/A (T #7 vs. T #10).

Table 6 shows that average sugar/A yields decreased from 1991 to 1992, remained stable from 1992 to 1993, and decreased from 1993 to 1994. Total sugar yield across four years progressively increased as nitrogen rates increased in the absence of calcium (T #1 vs T #4, T #4 vs. T #7, and T #7 vs. T #10). However, where calcium was added at either 20 or 40 lbs/A, there was no additional ($P \leq 0.10$) yield response to N above 120 lbs N/A.

Likewise, adding calcium to the 0, 60, and 180 lbs N/A treatments did not result in increased sugar yields. However, adding 40 lbs Ca/A to 120 lbs N/A (T #9 vs. T #7) did increase sugar yields across four years by 2,630 lbs/A, which was an equivalent yield response obtained from increasing nitrogen from 120 to 180 lbs/A in the absence of calcium (T #7 vs. T #10). This increase in sugar yield was associated with increased tonnage (Table 6) and increased stalk weights (Table 2).

Comparison of T #9 with T #7 shows that adding 40 lbs Ca/A to 120 lbs N/A resulted in sugar responses of 2%, 20%, 13%, and 12% in 1991, 1992, 1993, and 1994, respectively (Table 6). The same comparisons for cane tonnage (Table 5) showed increases of 5%, 18%, 9%, and 12%, respectively. Consequently, yield responses to N-hib Ca were higher in stubble crops than in plant cane, and responses were higher for first stubble than for second or third stubble.

Table 1. F-values for effect of harvest year and urea and N-hib Ca treatments on sugarcane yield parameters

		Stalk	Plant+		Cane	Sugar
Fertilizer						
% CV		11.20	11.68	6.14	12.04	9.90
RMSE		0.2245	3016	11.96	3.391	536.7
Year (Y)	3	343.36****	22.75****	131.61****	126.48****	25.31****
YxFT	33	1.41°	0.50	0.70	1.19	0.87
%CV		8.42	11.70	5.29	9.65	12.31
RMSE		0.1687	3021	10.32	2.719	667.6

°,*, and **** donate statistical significance at the P≤0.25, 0.05, and 0.0001 levels, respectively.

+Plant populations consisted of only three years of data; 1991, 1992, and 1994.

Table 2. Effect of urea and N-hib Ca on stalk weights across four years.

			Harvest years				
	- - lbs/acre - -		- - - - - - - - - - - - lbs/stalk - - - - - - - - - - - - -				
1	0	0	2.57	1.87	1.52	1.34	1.82
2	0	20	2.73	1.76	1.64	1.51	1.91
3	0	40	2.77	1.76	1.65	1.36	1.88
4	60	0	2.73	1.58	1.86	1.88	2.01
5	60	20	2.90	1.76	1.88	1.72	2.06
6	60	40	2.88	1.76	1.70	1.68	2.01
7	120	0	2.65	1.65	1.90	1.54	1.93
8	120	20	2.85	1.69	1.90	1.81	2.06
9	120	40	2.83	1.95	1.89	1.84	2.13
10	180	0	2.70	1.70	1.91	1.80	2.03
11	180	20	2.83	1.78	1.77	1.82	2.05
12	180	40	2.93	1.93	1.88	1.83	2.14
Avg.			2.78	1.77	1.79	1.68	
LSD 0.10					0.07+		0.16+
LSD 0.25					0.05+		0.11+

+LSD's for effect of harvest years on stalk weights averages across fertilizer treatments.

+LSD's for effect of fertilizer treatments on stalk weights averaged across harvest years.

Table 3. Effect of urea and N-hib Ca on plant populations across three years.

			Harvest years			
			1991	1993	1994	Avg.
T#	N	Ca				
	- - lbs/acre - -		- - - - - - - - - - 1000/A - - - - - - - - -			
1	0	0	21.5	23.9	22.4	22.6
2	0	20	22.3	23.5	23.0	22.9
3	0	40	20.9	23.2	24.5	22.9
4	60	0	24.7	29.1	25.7	26.5
5	60	20	23.5	29.6	24.6	25.9
6	60	40	23.4	27.8	25.3	25.5
7	120	0	22.9	29.1	25.7	25.9
8	120	20	23.4	29.7	28.7	27.3
9	120	40	25.2	32.1	26.0	27.8
10	180	0	24.4	29.9	29.0	27.7
11	180	20	24.5	31.3	28.8	28.2
12	180	40	23.7	28.9	27.2	26.6
Avg.			23.4	28.2	25.9	
LSD 0.10				1.2+		2.1±
LSD 0.25				0.8+		1.5±

+LSD's for effect of harvest years on plant populations averaged across fertilizer treatments.

±LSD's for effect of fertilizer treatments on plant populations.

Table 4. Effect of urea and N-hib Ca on commercially recoverable sugar across four years.

T#	N	Ca	Harvest years 1991	1992	1993	1994	Avg.
	- - - lbs/acre- -		- - - - - - - - - - - - - -lbs/ton - - - - - - - - - - - -				
1	0	0	178	216	184	196	193
2	0	20	172	214	179	203	192
3	0	40	175	225	179	212	198
4	60	0	184	224	181	198	197
5	60	20	164	220	186	193	191
6	60	40	180	218	181	198	194
7	120	0	182	219	185	203	197
8	120	20	169	225	190	200	196
9	120	40	177	222	191	202	198
10	180	0	180	222	180	191	193
11	180	20	177	222	188	194	195
12	180	40	178	227	182	197	196
Avg.			176	221	184	199	
LSD 0.10					4+		NS±
LSD 0.25					3+		NS±

+LSD's for effect of harvest years on CRS averaged across fertilizer treatments.
±LSD's for effect of fertilizer treatments on CRS across four years.

Table 5. Effect of urea and N-hib Ca on sugarcane tonnage across four years.

T#	N	Ca	Harvest years 1991	1992	1993	1994	Total
	- - lbs/acre - -		- - - - - - - - - - - - tons/acre - - - - - - - - - - - -				
1	0	0	30.9	19.7	21.3	17.4	89.3
2	0	20	32.0	19.8	21.7	17.6	91.1
3	0	40	31.5	19.6	20.9	17.5	89.5
4	60	0	36.9	21.5	29.1	25.0	112.5
5	60	20	35.1	23.2	29.3	22.5	110.1
6	60	40	33.3	23.2	28.9	23.3	108.7
7	120	0	34.2	24.4	31.3	26.4	116.3
8	120	20	37.5	24.5	30.1	28.2	120.3
9	120	40	36.0	28.9	34.1	29.5	128.5
10	180	0	39.0	26.5	34.3	29.3	129.1
11	180	20	37.8	28.0	30.2	28.5	124.5
12	180	40	37.8	31.5	33.4	29.1	131.8
Avg.			35.2	24.2	28.7	24.5	
LSD 0.10					1.1+		9.5±
LSD 0.25					0.7+		6.5±

+LSD's for effect of harvest years on cane tonnage averaged across fertilizer treatments.
±LSD's for effect of fertilizer treatments on total cane tonnage across four years.

Table 6. Effect of urea and N-hib Ca on sugar yields across four years.

T#	N	Ca	Harvest years 1991	1992	1993	1994	Total
	- - lbs/acre - - -		- - - - - - - - - - - - - - lbs/acre - - - - - - - - - - - - - -				
1	0	0	5520	4260	3920	3410	17,110
2	0	20	5510	4220	3880	3580	17,190
3	0	40	5510	4400	3750	3690	17,350
4	60	0	6770	4800	5260	4920	21,750
5	60	20	5730	5070	5430	4310	20,540
6	60	40	6000	5060	5200	4620	20,880
7	120	0	6220	5320	5770	5340	22,650
8	120	20	6330	5500	5650	5640	23,120
9	120	40	6370	6410	6510	5990	25,280
10	180	0	7000	5890	6190	5580	24,660
11	180	20	6680	6180	5680	5550	24,090
12	180	40	6730	7140	6080	5730	25,680
Avg.			6200	5360	5280	4860	
LSD 0.10					260+		1510±
LSD 0.25					180+		1040±

+LSD's for effect of harvest years on sugar yields averaged across ferilizer treatments.
±LSD's for effect of fertilizer treatments on total sugar yields across four years.

KENAF AND SUGARCANE
RESEARCH ON FIBER PRODUCTION IN 1995

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Agronomy Department

in cooperation with
St. Gabriel Research Station

SUMMARY:

Experiments were conducted in 1995 to compare fiber production in Kenaf varieties and a wild sugarcane variety with different fertilizer treatments. In Kenaf, varieties Cubano and Tainung 2 were tested with 0-0-0, 80-0-0, 160-0-0, and 160-40-80 lbs/A of NPK fertilizers. Tainung 2 produced a higher fiber yield per acre than Cubano, especially at the higher fertilizer rates. The average yields increased with each increment increase in fertilizer rates.

In sugarcane, a wild cane type variety L 79-1002 was tested in third stubble with 0-0-0, 160-0-0 and 160-60-120 lbs/A of NPK fertilizers. The N and NPK fertilizer treatments increased the stalk weight, cane yield and fiber yield, but the differences in all the yield components between the two applied rates were small. The highest average yields of fiber produced were 13.3 T/A in Kenaf and 14.6 T/A in the wild cane. In addition to fiber, the cane produced up to 1,557 lbs/A of sugar. The Kenaf contained bast and core fibers, and the cane contained typical bagasse fiber.

OBJECTIVES:

The research was initiated to evaluate the potential of growing Kenaf and high-fiber sugarcane as alternate crops for the production of fiber.

RESULTS AND DISCUSSION:

The following experiments were located on a Commerce soil on the St. Gabriel Research Station.

Kenaf Fiber Production

An experiment was conducted to test the effects of rates of fertilizer application with different varieties of Kenaf. The rates tested were 0-0-0, 80-0-0, 160-0-0 and 160-40-80 lbs/A of NPK fertilizers. The varieties tested with each rate were Cubano and Tainung 2. The fertilizer treatments were bedded in the rows prior to planting. The Kenaf plots were planted in two drills, 22 inches apart on sugarcane size rows six feet wide. The seeding rate was 80,000 seeds per acre. Prowl was applied as a pre-emergence herbicide at planting time to control weeds. The plots were planted on May 5 and the crop was cut with a sugarcane harvester in November 1995. All the stalks on each plot were weighed in the field. The drill and row spacings were chosen to accommodate sugarcane harvesting equipment so that the crop could be cut, weighed, and loaded mechanically at harvest time.

The stalk yield, average stalk weight, and percent fiber in the stalks were measured at harvest time. The percent bast and core fibers in the stalks were determined by crushing 10-stalk samples in a sugarcane laboratory mill and separating the fibers by hand. The percent and yield per acre of bast and core fibers were calculated for each plot.

The data obtained on the yield components of each variety and fertilizer treatment are reported in Table 1. The Tainung 2 variety produced higher stalk and fiber yields per acre than Cubano especially at the higher fertilizer rates. The increase in stalk yield from 80 lbs/A of N was significant in Cubano and increases from 160-0-0 and 160-40-80 fertilizers over the check plot were significant in each variety. The mean effect data show the stalk and fiber yields were higher in Tainung 2 than in Cubano and the yields increased with each increment increase in fertilizer rates. The highest yield was produced in Tainung 2 with 160-40-80 lbs/A of NPK fertilizer.

The data obtained on the yield of bast and core fibers are reported in Table 2. Variety Tainung 2 was lower in percent bast fiber and higher in percent core fiber and core fiber yield per acre than Cubano. As an average of varieties, the bast fiber yield increased with each N rate and the core fiber yield increased with the N and NPK rates. Tainung 2 with 160-40-80 lbs/A of NPK fertilizer produced 4.8 T/A of bast fiber and 8.5 T/A of core fiber for the highest total fiber yield of 13.3 T/A.

Sugarcane Fiber and Sugar Production

An experiment was conducted to test the effects of fertilizer rates on the fiber and sugar production of a wild cane variety L 79-1002. This cane variety is a progeny from crossing CP 52-68 X Tianan 96. CP 52-68 was a major variety grown in Louisiana in the 1960s and Tianan 96 is a wild type of sugarcane which grows without cultivation in Argentina. Variety L 79-1002 is a high fiber cane with a high stalk population, small stalk diameter, and high stubbling ability.

Variety L 79-1002 was planted in replicated plots, and the fertilizer treatments were applied in plant cane in 1992, first stubble in 1993, second stubble in 1994, and third stubble in 1995. The rates tested consisted of 0-0-0, 160-0-0, and 160-60-120 lbs/A of NPK. The treatments were applied in the spring and normal cane cultural practices were used during the growing season. The cane was cut with a cane harvester and weighed in November to measure the fiber, cane, and sugar yields. The stalk population and weight were determined at harvest time. A 20-stalk sample from each plot was used to measure the percent fiber and sucrose in the laboratory.

The data obtained in this test are reported in Table 3. The stalk population was very high and the average stalk weight was relatively low on each plot as compared to commercial cane varieties. The N and NPK fertilizer rates increased the stalk weight, cane yield and fiber yield, but the differences in all the yield components between N and NPK rates were small. The 160-0-0 fertilizer treatment produced the highest yields, consisting of 35.5 T/A of cane stalks, 14.6 T/A of fiber, and 1557 lbs/A of sugar per acre.

Kenaf and Cane Fiber Comparison

The highest average yields of dry fiber produced were 13.3 T/A in Kenaf and 14.6 T/A in the wild sugarcane. The fiber yields were similar, but the types of fiber in each crop were different. Kenaf bast fiber is long individual fibers, and core fiber is soft and spongy fiber contained in the inter-core of the stalks. The bast and core fibers are used for different purposes in industry and must be processed separately. The cane fiber is typical bagasse fiber, generally used to burn and generate power in sugar mills. However, the wild cane also produced up to 1557 lbs/A of sugar, equal to about one-fourth the average sugar yields of commercial cane varieties.

The Kenaf varieties and the wild cane variety were considerably taller than the maximum topping height of a cane harvester, and the fiber yields reported are lower than the yield actually produced in the field.

Table 1. Effect of varieties and fertilizer rates on the yield components of Kenaf grown on Commerce soil on the St. Gabriel Research Station, 1995.

Kenaf variety	Fertilizer $N-P_2O_5-K_2O$	Stalk			Fiber yield
		Yield	Weight	Fiber	
	lbs/A	T/A	lbs	%	T/A
Cubano	0-0-0	23.1	0.83	43.3	10.0
	80-0-0	27.0	0.91	43.8	11.8
	160-0-0	30.3	1.00	44.5	13.5
	160-40-80	31.5	1.05	43.6	13.7
Tainung 2	0-0-0	27.3	0.83	40.6	11.1
	80-0-0	29.6	1.00	41.4	11.9
	160-0-0	34.3	1.02	41.3	14.2
	160-40-80	37.0	0.96	43.1	16.0
LSD .05 Treatments		3.7			1.6
		Mean Effect			
Cubano		28.0	0.95	43.8	12.3
Tainung 2		31.8	0.95	41.6	13.3
	0-0-0	25.2	0.83	42.0	10.6
	80-0-0	27.8	0.96	42.6	11.9
	160-0-0	32.3	1.01	42.9	13.9
	160-40-80	34.2	1.01	43.4	14.8
LSD .05 Variety		1.9			0.8
LSD .05 Fertilizer		2.6			1.1

Table 2. Effect of varieties and fertilizer rates on fiber yield of Kenaf grown on Commerce soil on the St. Gabriel Research Station, 1995.

Kenaf variety	Fertilizer $N-P_2O_5-K_2O$	Dry Fiber Yield			
		Bast Fiber		Core Fiber	
	lbs/A	%	T/A	%	T/A
Cubano	0-0-0	39.2	3.9	60.8	6.1
	80-0-0	39.4	4.7	60.6	7.2
	160-0-0	42.2	5.7	57.8	7.8
	160-40-80	38.5	5.3	61.5	8.4
Tainung 2	0-0-0	35.6	4.0	64.4	7.1
	80-0-0	36.5	4.3	63.5	7.5
	160-0-0	35.7	5.1	64.3	9.1
	160-40-80	35.6	5.7	64.4	10.3
LSD .05 Treatments			0.6		1.0
		Mean Effect			
Cubano		39.8	4.9	60.2	7.4
Tainung 2		35.9	4.8	64.1	8.5
	0-0-0	37.4	4.0	62.6	6.6
	80-0-0	38.0	4.5	62.0	7.4
	160-0-0	39.0	5.4	61.1	8.4
	160-40-80	37.1	5.5	62.9	9.4
LSD .05 Variety			NS		0.5
LSD .05 Fertilizer			0.4		0.7

Table 3. Effect of fertilizers on the fiber and sugar yields of a wild cane variety L 79-1002 in third stubble on a Commerce soil in 1995.

Fertilizer N-P-K	Stalk No.	Stalk Wt.	Dry Stalk Fiber Yield	Cane Yield	Stalk Sucrose	Sugar Yield
lbs/A	1000/A	lbs	%	T/A	%	lbs/A
0-0-0	77.3	0.58	38.9	8.6	22.0	3.0	993
160-0-0	90.2	0.79	41.0	14.6	35.5	2.8	1557
160-60-120	93.3	0.74	38.7	13.3	34.3	2.8	1371
LSD .05	NS	0.08	NS	4.3	5.0	NS	NS

Sucrose is expressed as percent of stalk weight. Variety L 79-1002 is an F_1 progeny from crossing CP 52-68 X Tianan 96 (a wild type cane from Argentina).

ECONOMIC RESEARCH IN SUGARCANE IN 1995

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Projected costs and returns for the various stages of sugarcane production in Louisiana were estimated for the 1996 crop year. Production costs were estimated for farms using three-row machinery and production practices used by most growers in the main sugarcane producing areas. Specific operations for which production costs were estimated included field operations on fallow land, seedbed preparation, cutting and planting heat treated seedcane, planting cultured seedcane, field operations on plantcane, first stubble, second stubble, and third stubble, succession planting, as well as the costs of harvesting with one-row and two-row harvesters. Costs and returns were estimated for tenant-operators, reflecting the predominant land tenure situation, and reflect a mill payment of 39% of production and a land rent payment of 20% of the "after milling crop" proceeds (12.2% of production).

Expected raw sugar output per rotational acre is shown in table 1. A normal sugarcane land rotation is assumed with 25% of land in plantcane, first stubble, second stubble, and fallow. Estimated costs and returns per rotational acre of land in sugarcane are shown in table 2 for the River and Teche regions for both sandy and clay soils. Residual returns above total specified expenses and overhead were higher for farms in the River Region than for farms in the Teche Region. Within each region, residual returns were slightly higher for sugarcane production on clay soils than on sandy soils.

A study was conducted to evaluate the economic returns associated with alternative sugarcane varieties and crop yield patterns. Annualized value of net returns (AVNR), the average annual value of returns above variable and fixed production costs from a crop cycle adjusted for inflation, was estimated for 10 commercial cultivars using a typical Louisiana tenant farmer cost structure and one to three crop cycles of data collected from 10 locations between 1990 and 1994 (table 3). Yield patterns were variable, but generally there was more yield decline between first and second ratoon crops than between the plant cane and first ratoon crops. Alternative crop yield patterns among a four-year crop cycle of cultivars with the same average sugar yield exhibited minor differences in profitability. Differences in absolute yield potential versus yield pattern among crops produced most of the AVNR variation among cultivars. Strong cultivar by location interaction, however, suggested that optimum cultivar choices may vary with location. Comparison of known second ratoon yields and the average AVNR for each cultivar-location mean indicated that returns would have been maximized by plowing out the second ratoon crop between 15% for CP 65-357 to 5% for CP 74-383 then replanting after a one-year fallow. Thus, 85% to 95% of the time, a fixed four-year cycle was more profitable than a fixed three-year cycle for these cultivars in these tests. The minimum yield to justify retention of the third ratoon crop for harvest was also estimated. The minimum yield depended on the three previous crop yields as well as the variety to be planted as part of a new crop cycle. This suggested that the most profitable crop rotation scheme will vary with cultivar and field may require the destruction a ratoon crop with a profitable yield.

Table 1. Expected Output per Rotational Acre for Tenants and Owner Operators, Sugarcane, Louisiana, 1996.

Item	Land Use	Plant Cane		1st Stubble		2nd Stubble		Marketable Output per Rotational Acre
		Tenant	Owner	Tenant	Owner	Tenant	Owner	
	(%)	Sugar Yield (lbs. of CRS)						
Land	100.0	6000	6000	4800	4800	4200	4200	
Harvested Rotational Cane 1/:								
Plant Cane	25.00	1500	1500	0	0	0	0	
Plant Cane for Seed 2/	4.17	250	250	0	0	0	0	
1st Stubble	25.00	0	0	1200	1200	0	0	
1st Stubble for Seed	0.69	0	0	33	33	0	0	
2nd Stubble	25.00	0	0	0	0	1050	1050	
Fallow	25.00	0	0	0	0	0	0	
Total Raw Sugar		1250	1250	1167	1167	1050	1050	
Mill/Landlord Share:								
Mill	39.00	487	487	455	455	410	410	
Land Rent 3/	12.20	152	0	142	0	128	0	
Grower's Share 4/:								
Tenant		610	0	569	0	512	0	1692
Owner Operator		0	762	0	712	0	641	2115

1/ Assumes a normal land rotation of 25% each of plant cane, 1st stubble, 2nd stubble, and fallow.

2/ Assumes .694 acres of disease-free cultured seed planted annually with two expansions plus use of 1st stubble of seed for every 25 acres planted each year. One acre of cane cut for seed will plant five acres. Plant cane and 1st stubble cut for seed (4.86 acres) will plant 24.3 acres, plus .694 acres planted in new disease-free seed yields 25 acres planted.

3/ 20 percent of "after milling crop proceeds."

4/ Grower's share is total raw sugar less amount taken for mill share and land rent.

Table 2. Summary of Projected Costs and Returns per Rotational Acre of Land in Sugarcane, Tenant Operator, All Regions, Louisiana, 1996 1/.

Production Area	Adjusted Yield Per Acre 2/	Total Income 3,4,5/	Total Direct Costs	Returns Above Direct Costs	Total Fixed Costs	Total Specified Costs	Returns Above Specified Costs	Overhead Costs	Residual Returns
	--cwt--	dollars							
River Region									
Sandy Soils	16.92	397.51	246.38	151.13	68.35	315.16	82.35	49.13	33.22
Clay Soils	16.92	397.51	243.91	153.60	67.06	311.44	86.07	49.13	36.94
Teche Region									
Sandy Soils	16.92	397.51	262.70	134.81	70.04	332.74	64.77	49.13	15.64
Clay Soils	16.92	397.51	260.36	137.15	69.02	329.38	68.13	49.13	19.00

1/ Computations based on a normal 4-year rotation consisting of 25% each of fallow/plant, plant cane, 1st stubble, and 2nd stubble. Acres given up for seed include 4.17 acres of plant cane and .69 acres of 1st stubble.
2/ Reflects the raw sugar output to a tenant grower per rotational acre of land in sugarcane as specified in Table 1.
3/ Molasses output assumed to be 2.9 gallons per cwt. of raw sugar.
4/ Prices for raw sugar and molasses estimated at $21.50/cwt. and $0.38/gal., respectively.
5/ Includes the farm program market service payment on raw sugar (1.1% of the loan price per output unit) and contributions to the American Sugar Cane League check-off program.

Table 3. Sugar yields and changes among crops, second ratoon plowout percentages, and annualized net returns for three- and four-year crop cycles for 10 Louisiana sugarcane cultivars, 1991-1994.

Cultivar	Sugar yield				Minimum TR yield to justify harvest[2]	Yield decrease[3]			% Time SR crop should be destroyed	Annualized Net Return	
	PC[1]	FR	SR	Mean		PC to FR	FR to SR	PC to SR		3-year cycle	4-year cycle
	lbs/A					%				$/A	
CP 65-357	6450	5647	4815	5637	3765	10.5	14.1	25.0	15.0 ± 4.6	71.17	104.26
CP 70-321	6273	5568	4933	5591	3737	7.7	10.9	19.6	8.6 ± 3.7	63.26	101.16
CP 72-370	6426	6114	4970	5837	3908	3.9	18.5	22.5	10.4 ± 4.4	86.58	120.01
CP 74-383	6518	5862	5334	5905	3950	7.8	7.3	16.6	5.1 ± 2.9	80.57	124.57
CP 79-318	6673	6355	5700	6243	4184	1.8	9.8	12.9	11.9 ± 4.2	102.09	150.32
LCP 82-89	6571	6145	5411	6042	4047	3.4	9.5	15.8	7.0 ± 3.4	91.85	135.17
LHo 83-153	6541	6110	5481	6044	4049	3.3	9.0	14.8	8.6 ± 3.7	89.80	135.37
LCP 85-384	7594	7523	7085	7401	4971	-2.1	5.3	5.0	6.7 ± 3.2	169.18	236.76
HoCP 85-845	6881	6250	6016	6382	4274	6.4	1.6	11.4	5.3 ± 3.0	104.51	160.15
LCP 86-454	6849	6286	5280	6138	4108	5.3	15.4	20.8	7.0 ± 3.9	104.85	141.84
Mean	6679	6187	5521	6129	4104	4.8	9.8	16.2	8.6 ± 1.2	96.48	141.49
$LSD_{0.05}$	392	449	484	348	287	7.6	7.3	7.8		22.28	26.02

[1] PC - plant cane crop; FR - first ratoon crop; SR - second ratoon crop; TR - third ratoon crop.

[2] Assumes PC, FR and SR yields of same cultivar would be obtained if replanted, and TR costs and cane sugar concentration equal to SR cost and cane sugar concentration.

[3] Percent yield decrease was calculated on a per plot basis.

PILOT FACTORY RUNS CONDUCTED BY AUDUBON SUGAR INSTITUTE TO GENERATE SUGARCANE PROCESSING SAMPLES

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G. L. Hawkins, M. Fontenot, and D. Launey

Sugar Station/Audubon Sugar Institute

INTRODUCTION

Audubon Sugar Institute follows its Standard Operating Procedures to process sugarcane and follows Good Scientific Procedures to collect, store, and ship processing fractions that are representative of commercial sugar factory products.

OBJECTIVE

The objective of these processing studies was to generate commercially representative process fractions from sugarcane grown in the field.

PROCEDURES

Audubon Sugar Institute Standard Operating Procedures, which are based on Good Scientific Procedures, were used to process the untreated and treated sugarcane samples for two studies. Processing samples generated during these studies are representative of raw sugar factory and refinery products.

Sugarcane samples were received at the Audubon Sugar Factory. In the first study the 4-ton untreated sample of LCP82-89 was processed on October 9, 1996. The 4-ton sample treated with Fury® EC Insecticide was processed on October 16, 1996. In the second study the 4-ton untreated sample of LCP82-89 was processed on October 23, 1996. The 4-ton sample treated with Arsenate Liquid (formulation of MSMA) was processed on November 7, 1996. In each study, the lots of sugarcane were washed, then processed through the Audubon Sugar Factory mill tandem on the scheduled dates. The sugarcane was milled with 25% maceration water. The extracted (mixed) juice was limed and heated. After adding a polyelectrolyte flocculent to the hot juice, the mud was allowed to settle in the clarifier tanks. The clarified clear juice was transferred to the evaporator and evaporated to syrup.

The syrup was boiled, grained, and further boiled to form A-Massecuite. The A-Massecuite was centrifuged to separate the A-Sugar from A-Molasses. The A-Molasses was used to repeat the process, generating a B-Massecuite which was separated into B-Sugar and B-Molasses. The B-Molasses was used to repeat the process, generating C-Massecuite which was slowly cooled to facilitate maximum crystallization. The Final Molasses (also referred to as C-Molasses or Black Strap Molasses) was the residual after exhausting the molasses of

crystalline sugar. A sample of the Final Molasses was extracted from the C-Massecuite with a Nutch Bomb. During each crystallization and separation step, sucrose is removed from the "mother liquor." Accordingly, the purities (percent of total soluble solids that is sucrose) of the resulting molasses decrease.

The first step in producing white sugar was to dissolve proportionate amounts of A- and B-raw sugars were dissolved in pure water. The resulting syrup was decolorized with activated charcoal, filtered, and evaporated to crystallize the white or refined sugar. The crystalline white sugar was separated by centrifugation.

All processing samples (table 1) are immediately cooled and frozen. Samples are shipped to designated laboratories where analyses for the treated chemical were to be conducted.

Table 1. Samples and Amounts Collected During Processing

Sample	Amount
Whole Stalk Cane	4 lbs.
Mixed Juice	1000g
Bagasse	1000g
Clarified Juice	1000g
Syrup	1000g
Filter Cake	750g
Composite A-Sugar	500g
Composite B-Sugar	500g
Composite Final Molasses	1000g
White Sugar	200g

ANALYSIS OF FINAL MOLASSES FROM LOUISIANA SUGAR FACTORIES

ASI Staff
Audubon Sugar Institute

During the 1995 sugarcane harvest season, weekly composites of final molasses samples sent to Audubon Sugar Institute were analyzed by the ASI staff. Samples were analyzed for refractometer Brix, pol, sucrose, reducing substances, and conductivity ash. The people involved and their responsibilities were as follows:

Willem Kampen	Diluted the final molasses samples.
Monica Fontenot	Analyzed samples for refractometer Brix and pol.
Teresa Garcia	Analyzed reducing substances by Lane-Eynon.
Don Day Durriya Sarkar	Measured conductivity ash.
Michael Saska Mei Wu	Analyzed sugars by HPLC
Harold Birkett Jeanie Stein	Mailed survey bottles to factories; calculated data and reviewed and communicated results to factories.

Equipment Used For Analyses

Brix: Bellingham & Stanley Refractometer Model RFM 90.
Pol: Rudolph Autopol IIS Saccharimeter.
Conductivity Ash: Radiometer Copenhagen.

Sugars by HPLC:	Column:	Bio-Rad HPX-87 300*7.8 mm at 85 deg. C.
	Solvent:	0.01 M K_2SO_4.
	Detector:	Waters 410 Differential Refractometer.
	Integrator:	Spectra-physics SP4270 Integrator.
	Pump:	Waters Associate Chromatography Pump, Model-M510.

A few changes were made in the annual survey procedures for the 1995 crop. Pre-crop and weekly in-crop samples were run and analyzed in the same manner as the weekly factory composites. The Lane-Eynon method for determining reducing substances was used in place of the HPLC method used in previous years. The Louisiana relationship between conductivity ash and sulfated ash was used in place of the previously used South African formula. The results of the analyses were used to calculate true purity, target purity, total sugars, and total sugars as invert. Because of the change in the ash calculation and the use of reducing substances (Lane-Eynon), the target purity formula was changed to the one used previously at ASI (in 1980-1985). This combination of different analyses and target purity

This project ws funded by the American Sugar Cane League.

formula resulted in a target that was approximately 5 points lower than would have been achieved with the previously used analytical methods and formula. The list of formulas used are as follows:

True solids = 1 (101.3/Refractometer Brix + 0.932/Sucrose) x 100.

Conductivity = Specific Conductance x 9.224072706938 + 2.511867497437.

Target Purity = 39.94 - 19.6 log (Reducing Sugars by Lane-Eynon/Conductivity Ash).

The state average results by week are shown in Table 1 and plotted in Figure 1. Results of the crop average for each factory are shown in Table 2 and plotted in Figure 2. Figure 3 shows results of the crop average for the past three years. Pre-crop and the in-crop control analytical results (controls) are presented in Table 3.

Table 1. Weekly results from final molasses analyses averaged across factories.

Week Ending	Ref. Brix	App. Purity	Red. Subst.	Cond. Ash	RS/ Ash	True Solids	True Sucrose	True Purity	Target Purity	Diff.	Total Sugars	TSI @ 80 Ref. Bx.
10/07/95	79.5	37.71	19.17	14.12	1.36	76.88	35.90	46.68	37.33	9.35	55.07	57.32
10/14/95	82.4	36.99	17.36	16.15	1.08	79.69	36.93	46.33	39.35	6.98	54.29	54.60
10/21/95	81.9	36.90	16.96	16.04	1.06	79.20	36.54	46.13	39.48	6.64	53.50	54.14
10/28/95	82.3	36.82	15.18	16.53	0.92	79.62	37.83	47.48	40.71	6.77	53.01	53.45
10/04/95	81.4	39.15	14.85	16.69	0.89	78.76	37.90	48.10	40.96	7.14	52.75	53.81
11/11/95	81.3	37.81	14.57	17.24	0.85	78.67	38.15	48.45	41.39	7.07	52.72	53.86
11/18/95	81.5	36.84	13.98	17.65	0.79	78.85	37.01	46.92	41.95	4.97	50.99	51.95
11/25/95	80.6	37.35	13.37	18.02	0.74	77.95	36.88	47.28	42.50	4.78	50.25	51.82
12/02/95	81.2	38.10	12.77	18.26	0.70	78.63	37.90	48.19	43.02	5.17	50.67	51.86
12/09/95	80.9	38.86	12.34	18.05	0.69	78.29	37.71	48.14	43.20	4.94	50.04	51.46
12/16/95	80.7	40.40	11.67	17.70	0.66	78.13	37.89	48.46	43.50	4.96	49.56	51.10
12/23/95	80.3	43.78	11.70	16.85	0.70	77.74	38.88	49.97	43.06	6.91	50.57	52.43
12/30/95	80.9	44.87	10.50	16.96	0.62	78.36	38.85	49.56	44.04	5.53	49.35	50.81
Crop Avg.	81.1	38.89	14.19	16.94	0.85	78.52	37.57	47.82	41.58	6.25	51.75	52.97

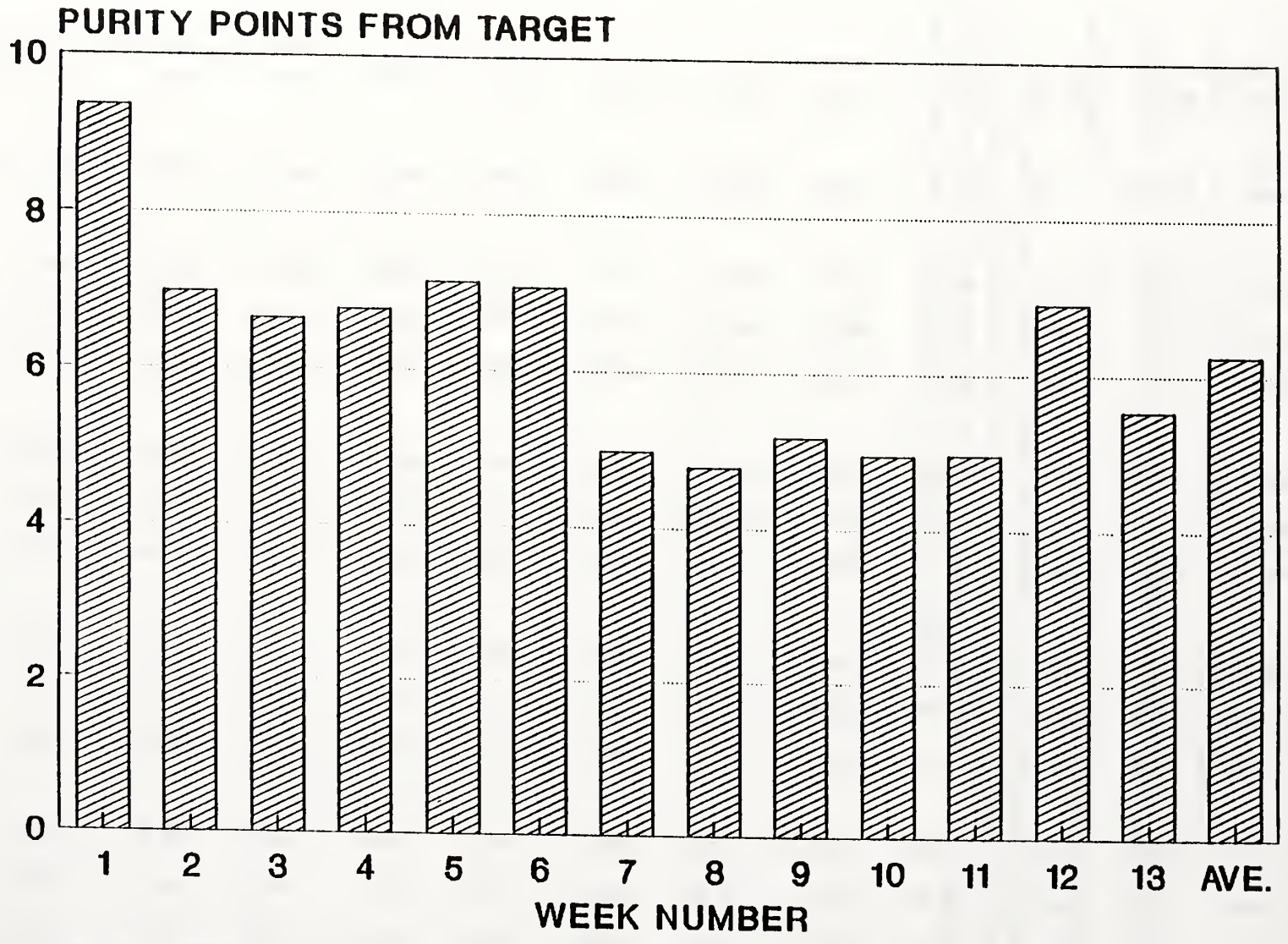


Figure 1. 1995 State average true purity less target purity vs week.

Table 2. Average analysis of final molasses for each Louisiana factory for the 1995 crop.

Factory	Ref. Brix	App. Purity	Red. Subst.	Cond. Ash	RS/ Ash	True Solids	True Sucrose	True Purity	Target Purity	Diff.	Total Sugars	TSI @ 80 Ref. Bx.
A	80.5	40.87	13.54	16.76	0.81	77.94	38.27	49.11	41.80	7.32	51.81	53.50
B	78.8	38.44	12.67	17.33	0.73	76.28	35.88	47.04	42.64	4.40	48.56	51.18
C	79.8	39.02	13.85	16.28	0.86	77.22	36.43	47.20	41.38	5.82	50.28	52.33
D	84.5	38.53	12.79	19.09	0.68	81.78	39.33	48.10	43.43	4.67	52.12	51.31
F	81.8	37.30	13.96	17.58	0.80	79.08	36.41	46.05	42.01	4.04	50.37	51.15
G	79.3	38.38	13.80	16.73	0.83	76.81	37.39	48.67	41.67	6.99	51.19	53.58
H	84.5	40.23	14.79	17.48	0.86	81.82	39.84	48.70	41.48	7.22	54.62	53.69
I	80.1	38.10	14.64	17.46	0.85	77.53	36.18	46.66	41.50	5.15	50.83	52.64
J	85.0	40.25	15.11	16.76	0.90	82.41	42.08	51.06	40.85	10.20	57.19	55.87
K	79.9	38.01	14.65	16.94	0.88	77.31	36.95	47.80	41.27	6.53	51.59	53.61
L	81.9	37.96	15.42	16.79	0.92	79.32	38.37	48.38	40.68	7.70	53.79	54.50
N	79.5	36.03	13.35	17.27	0.78	76.93	35.97	46.76	42.19	4.58	49.32	51.52
O	83.9	39.13	14.68	16.42	0.91	81.21	39.33	48.43	41.00	7.43	54.01	53.49
P	80.8	35.22	15.22	17.17	0.89	78.10	35.88	45.92	41.03	4.90	51.10	52.48
Q	80.8	36.21	14.65	17.55	0.84	78.08	35.33	45.25	41.51	3.75	49.98	51.35
R	79.1	36.30	14.89	16.54	0.91	76.48	35.82	46.82	40.99	5.83	50.71	53.19
S	81.9	42.88	11.44	17.72	0.65	79.40	40.48	50.99	43.72	7.27	51.93	52.78
W	81.1	38.83	13.71	17.68	0.78	78.50	37.24	47.43	42.16	5.27	50.95	52.17

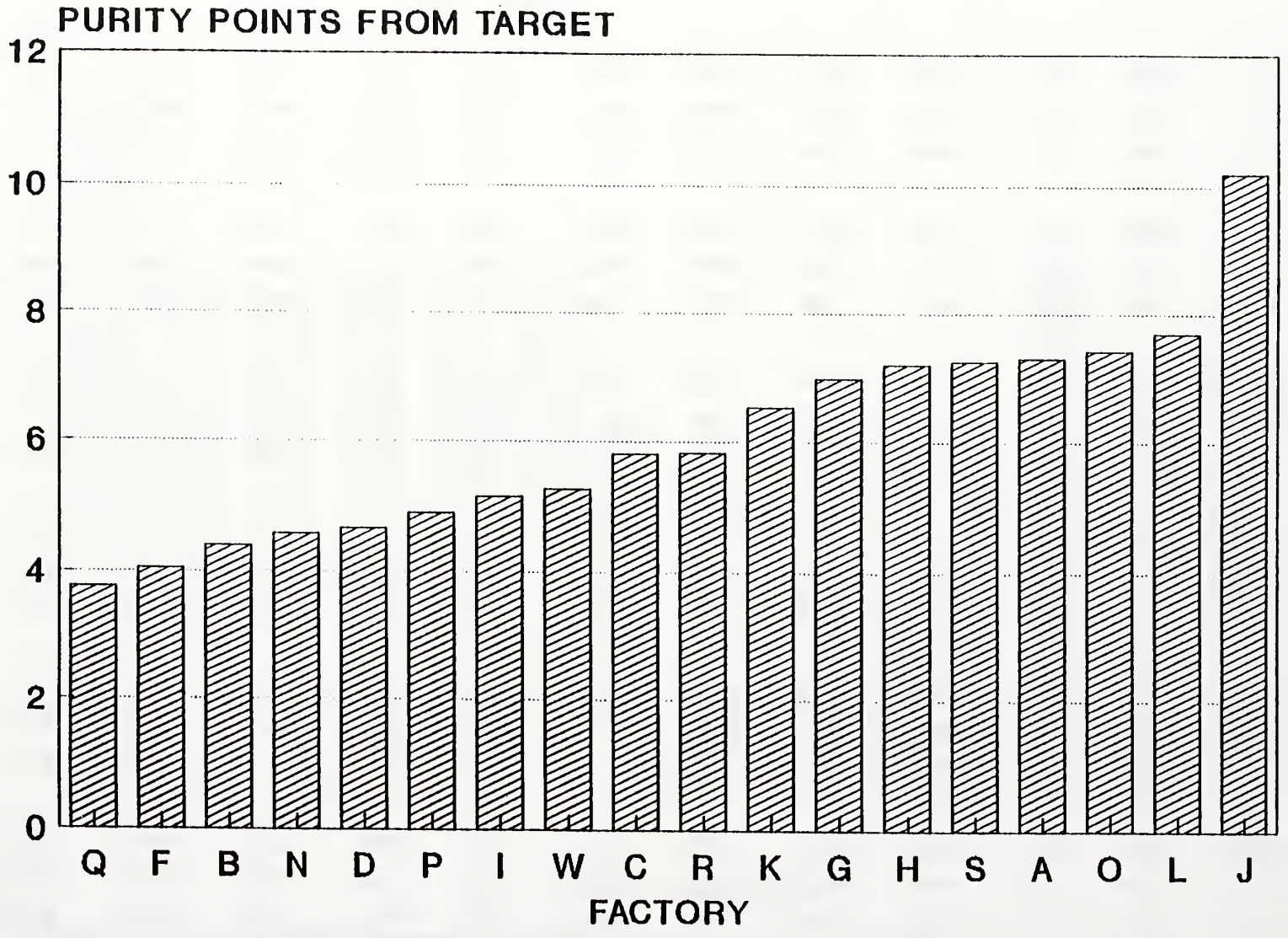
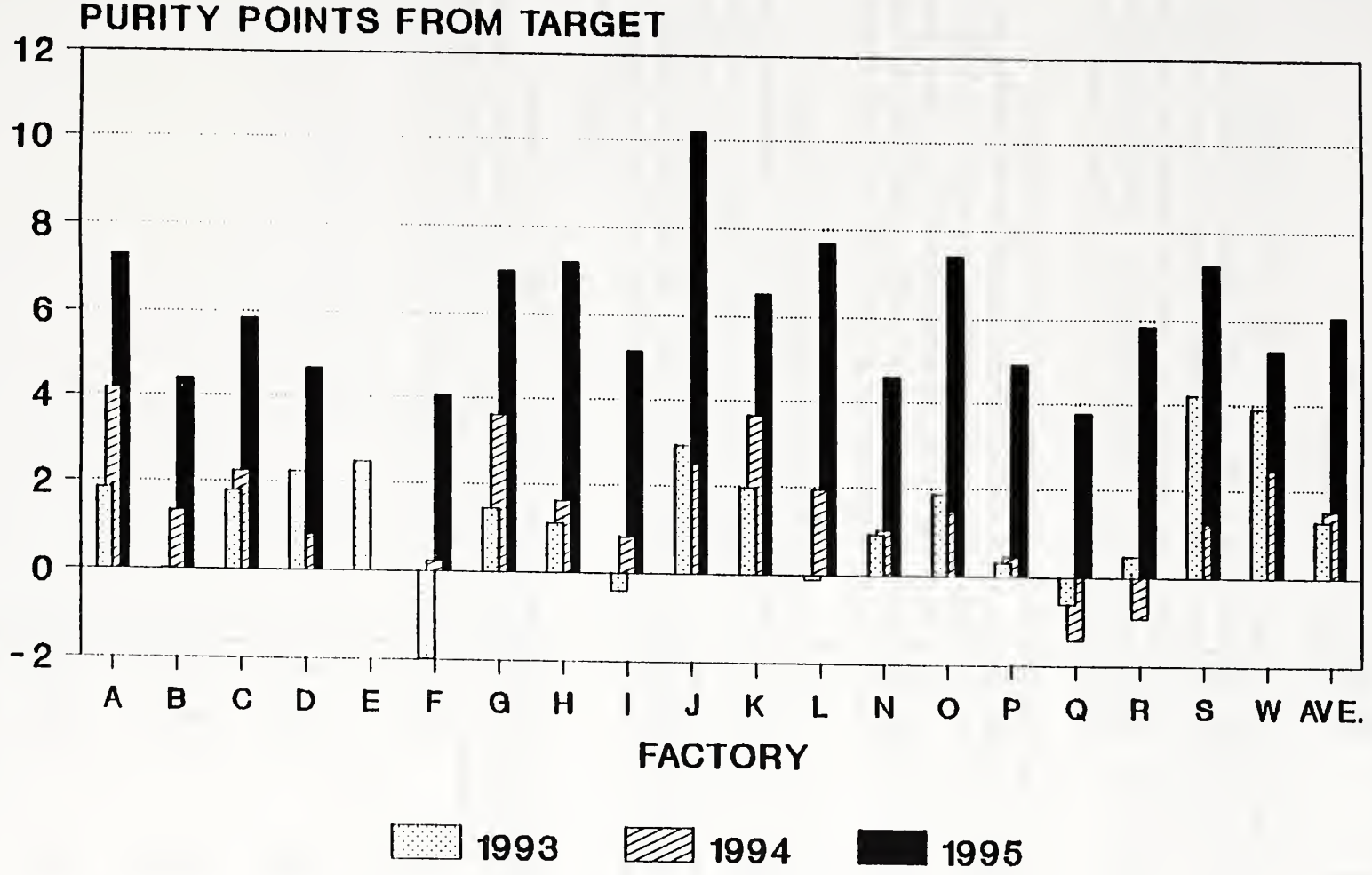


Figure 2. 1995 State average true purity less target purity vs factory - in ascending order.



No data for Factory E 1994 & 1995.
1993 & 1994: ASI Target Formula.
1995: SMRI Target Formula.

Figure 3. ASI Delta targets vs factories - 1993-95 crops.

Table 3. Means and standard deviations for pre-crop and in-crop and control samples run during 1995 ASI final molasses survey.

	Ref. Brix	App. Purity	Red. Subst.	Cond. Ash	RS/ Ash	True Solids	True Sucrose	True Purity	Target Purity	Diff.	Total Sugars	TSI @ 80 Ref. Bx.
Pre-Crop												
Average	74.6	40.12	16.67	14.09	1.18	72.17	33.58	46.53	38.51	8.03	50.25	55.79
St. Dev.	0.1	0.48	0.09	0.27	0.03	0.12	0.59	0.81	0.18	0.78	0.59	0.68
In-Crop												
Average	74.5	39.90	16.58	13.92	1.19	72.09	34.02	47.19	38.45	8.74	50.60	56.26
St. Dev.	0.3	1.26	0.19	0.17	0.02	0.32	0.37	0.49	0.12	0.53	0.48	0.51

MILL PERFORMANCE TESTS IN LOUISIANA SUGAR FACTORIES

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Audubon Sugar Institute

During the 1995 crop 16 milling tests were conducted at 13 factories. Samples of prepared cane and bagasse from each mill in the tandem were collected. These samples were analyzed for pol, moisture, fiber, and ash content using standard methods. Moisture percent bagasse, pol percent bagasse, and individual and cumulative pol extractions were determined for each mill tested. Preparation index of prepared cane along with the percent open cells in the bagasse leaving each mill in the tandem was also determined.

The percent open cells was measured by first dividing a sample into two subsamples. One subsample was washed for 30 minutes using a tumbler turning at approximately 19 rpm while the other sample was digested using a Waring blender for 5 minutes. Both samples were made up to have the same sample to water ratio of 10:1. The percentage of open cells was calculated as the difference between the digested pol percent fiber and the washed pol percent fiber divided by the pol percent fiber in cane expressed as a percent.

Prepared cane and bagasse density tests were conducted using prepared cane and bagasse samples collected at St. James Sugar Cooperative and Savoie Industries, Inc. The core lab press container at St. James was charged with a weighed quantity (between 480 and 1000 grams) of each sample. Samples collected at St. James were pressed for 3 minutes at hydraulic pressures of 500, 1000, 2000, and 2500 psig. After pressing, the sample residue was weighed and analyzed for moisture percent bagasse, fiber percent bagasse, and ash percent bagasse.

Results of each factory's moisture percent bagasse, pol percent bagasse, fiber percent bagasse, ash percent bagasse, individual mill extraction, cumulative pol extraction, and percent open cells are given in Tables 1 through 7 and are summarized in Table 8. Results of density tests are given in Tables 9 and 10.

This project was funded by the American Sugar Cane League.

Table 1. Moisture Percent Bagasse vs Mill Number

	Moisture Percent Bagasse							
	Mill Number							
Factory	PC	1	2	3	4	5	6	7
F-1	73.45	59.54	53.43	51.72	54.12			
C-1	71.86	58.95	57.17	58.46	57.18	51.06		
C-2	70.07	60.32	60.48	62.23	56.81	49.88		
C-3	71.81	---	---	---	---	50.46		
K-1	72.44	59.94	57.13	56.85	57.57	51.62		
Q-1	71.57	57.52	59.40	54.53	54.71	50.70		
B-1	72.34	61.58	58.62	57.37	56.89	56.73	53.91	
B-2	73.57	63.99	59.85	60.88	61.82	60.54	58.22	
D-1	72.22	59.29	64.94	61.64	66.80	65.89	59.84	
E-1	73.51	55.14	60.47	53.48	53.79	54.74	49.31	
G-1	76.86	61.28	59.45	57.03	57.66	52.91	51.08	
I-1	70.41	59.05	60.49	60.68	61.96	63.00	56.76	
L-1	73.13	71.33	64.92	61.95	67.08	62.04	60.53	
O-1	73.10	64.29	60.00	60.08	56.22	59.19	56.37	
W-1	75.03	73.67	71.93	60.30	59.55	55.59	52.58	
S-1	73.40	64.13	62.56	60.22	57.91	59.45	54.74	53.41
Average:								
1995	72.80	62.00	60.72	58.49	58.67	56.25	55.33	53.41
1994	72.10	64.46	61.18	58.75	57.55	58.26	53.85	53.80
1993	72.57	64.13	61.41	59.19	58.19	57.27	55.61	53.79

--- not sampled

Table 2. Pol Percent Bagasse vs Mill Number

	Pol Percent Bagasse							
		Mill Number						
Factory	PC	1	2	3	4	5	6	7
F-1	11.94	8.58	6.36	4.46	3.12			
C-1	11.54	8.36	6.25	4.38	2.91	2.23		
C-2	12.15	9.55	7.13	4.70	3.32	2.37		
C-3	10.42	---	---	---	---	1.71		
K-1	11.38	9.29	7.98	6.47	5.16	3.81		
Q-1	12.89	8.98	7.52	5.61	4.23	2.75		
B-1	12.00	10.03	7.54	5.58	3.93	3.01	2.26	
B-2	9.68	8.38	6.58	5.04	3.73	2.75	2.11	
D-1	12.52	9.51	7.89	6.58	5.45	4.60	3.49	
E-1	11.82	8.41	8.03	6.25	4.73	3.57	2.28	
G-1	11.31	8.89	7.28	5.27	4.50	2.76	2.42	
I-1	12.72	10.38	8.51	7.42	6.42	5.13	3.77	
L-1	11.56	11.15	8.92	7.68	6.43	5.09	3.52	
O-1	12.73	10.47	7.43	6.01	5.29	3.99	3.10	
W-1	8.68	8.28	7.41	5.77	4.18	2.83	2.54	
S-1	10.92	8.26	7.10	6.07	4.89	3.44	2.49	2.10
Average:								
1995	11.52	9.23	7.46	5.82	4.55	3.34	2.80	2.10
1994	11.82	9.94	8.34	6.57	5.31	4.10	3.11	2.48
1993	11.24	9.47	7.67	6.36	5.20	3.91	3.07	2.13

--- not sampled

Table 3. Fiber Percent Bagasse vs Mill Number

	Fiber Percent Bagasse							
	Mill Number							
Factory	PC	1	2	3	4	5	6	7
F-1	13.09	29.09	36.28	40.40	39.49			
C-1	13.30	28.56	31.99	33.68	34.80	42.35		
C-2	15.71	25.62	25.10	29.96	34.49	41.79		
C-3	15.19	---	---	---	---	40.94		
K-1	13.88	26.71	30.71	32.54	32.99	38.54		
Q-1	13.92	31.09	29.27	36.41	36.72	42.77		
B-1	13.10	25.44	30.57	33.04	34.31	37.73	40.52	
B-2	11.41	22.16	27.88	29.45	28.77	31.55	33.52	
D-1	13.19	27.65	24.15	28.35	24.71	26.99	33.87	
E-1	12.25	32.79	28.20	35.97	36.35	36.66	42.66	
G-1	12.60	24.89	27.63	32.67	31.45	38.33	40.91	
I-1	13.68	26.63	27.27	27.63	26.48	28.02	35.00	
L-1	13.35	14.78	24.59	26.52	24.35	29.62	33.19	
O-1	11.67	22.93	29.30	29.83	34.13	34.14	37.06	
W-1	12.91	17.06	24.75	28.75	29.24	34.51	36.07	
S-1	13.04	22.55	25.52	28.67	30.82	31.72	37.83	38.38
Average:								
1995	13.27	25.20	28.21	31.59	31.94	35.71	37.06	38.38
1994	13.30	21.61	25.78	29.60	31.31	32.66	36.53	39.18
1993	12.90	22.41	26.11	29.36	31.23	33.18	36.16	37.07

--- not sampled

Table 4. Ash Percent Bagasse vs Mill Number

	Ash Percent Bagasse							
	Mill Number							
Factory	PC	1	2	3	4	5	6	7
F-1	0.84	1.26	1.36	1.43	1.28			
C-1	1.03	1.49	1.63	1.67	1.85	2.34		
C-2	1.36	2.76	2.71	2.74	3.66	3.72		
C-3	1.19	---	---	---	---	3.03		
K-1	1.36	1.62	1.68	1.78	1.66	2.05		
Q-1	1.05	1.78	1.81	2.90	2.10	2.14		
B-1	0.99	1.41	1.41	1.39	1.41	1.39	1.42	
B-2	3.44	2.70	3.05	2.61	2.77	3.00	2.89	
D-1	0.80	1.22	1.09	1.14	0.97	1.04	1.04	
E-1	1.27	1.68	1.51	1.91	1.95	2.16	3.35	
G-1	2.25	2.99	4.07	3.26	3.68	3.78	3.48	
I-1	0.89	1.21	1.09	1.14	1.20	1.15	1.27	
L-1	0.96	1.14	1.38	1.69	2.00	1.97	2.32	
O-1	0.70	0.89	1.09	1.06	1.20	1.13	1.16	
W-1	1.70	2.02	1.94	2.52	3.28	3.47	3.83	
S-1	1.11	3.34	2.51	2.53	3.26	2.32	2.82	2.72
Average:								
1995	1.31	1.83	1.89	1.98	2.15	2.31	2.36	2.72
1994	1.06	1.36	1.56	1.65	1.63	1.78	1.79	0.99
1993	1.28	1.59	1.90	1.98	2.04	2.06	2.45	3.26

--- not sampled

Table 5. Individual Mill Extraction vs Mill Number

	Individual Mill Extraction						
	Mill Number						
Factory	1	2	3	4	5	6	7
F-1	67.68	40.53	36.99	28.58			
C-1	66.29	33.26	33.41	35.75	37.06		
C-2	51.79	23.86	44.73	38.58	41.26		
C-3	---	---	---	---	---		
K-1	57.57	25.32	23.51	21.29	36.82		
Q-1	68.82	11.06	39.96	25.29	44.21		
B-1	56.96	37.48	31.53	32.05	30.42	30.13	
B-2	55.43	37.60	27.50	24.17	32.80	27.88	
D-1	63.77	5.01	28.99	4.88	22.70	39.54	
E-1	73.43	-10.99**	38.92	25.15	25.22	45.02	
G-1	60.21	26.25	38.72	11.33	49.68	17.75	
I-1	58.10	19.98	13.95	9.68	24.51	41.21	
L-1	12.88	51.90	20.21	8.73	34.91	38.27	
O-1	58.16	44.46	20.58	23.03	24.63	28.55	
W-1	37.39**	38.31	33.00	28.78	42.67	13.83	
S-1	56.25	24.13	23.83	25.05	31.60	39.49	16.81
Average:							
1995	56.32	27.21	30.39	22.82	34.18	32.17	16.81
1994	45.09	28.64	31.78	20.33	32.02	33.97	38.08
1993	50.04	29.94	25.52	23.38	28.82	34.66	33.17

** two-roll crusher
--- not sampled

Table 6. Cumulative Pol Extraction vs Mill Number

	Cumulative Pol Extraction						
	Mill Number						
Factory	1	2	3	4	5	6	7
F-1	67.68	80.78	87.89	91.35			
C-1	66.29	77.50	85.02	90.37	93.94		
C-2	51.79	63.29	79.71	87.54	92.68		
C-3	---	---	---	---	93.92		
K-1	57.57	68.31	75.76	80.92	87.95		
Q-1	68.82	72.27	83.35	87.56	93.06		
B-1	56.96	73.09	81.58	87.48	91.29	93.91	
B-2	55.43	72.19	79.84	84.71	89.72	92.59	
D-1	63.77	65.58	75.56	76.75	82.03	89.13	
E-1	73.43	70.51	81.99	86.52	89.92	94.46	
G-1	60.21	70.66	82.02	84.06	91.98	93.40	
I-1	58.10	66.47	71.15	73.94	80.33	88.44	
L-1	12.88	58.09	66.56	69.48	80.14	87.74	
O-1	58.16	76.76	81.54	85.79	89.29	92.35	
W-1	37.39	55.46	70.16	78.75	87.82	89.50	
S-1	56.25	66.81	74.71	81.05	87.04	92.16	93.47
Average:							
1995	56.32	69.18	78.46	83.08	88.74	91.37	93.47
1994	45.09	61.38	73.82	79.63	85.65	89.73	93.27
1993	50.04	65.73	74.50	80.32	86.19	89.90	93.07

--- not sampled

Table 7. Percent Open Cells vs Mill Number

	Percent Open Cells							
	Mill Number							
Factory	PC	1	2	3	4	5	6	7
F-1	70.18	89.93	94.90	97.53	98.32			
C-1	82.01	93.86	96.53	97.01	98.36	99.03		
C-2	85.85	89.15	93.81	96.28	97.51	98.64		
C-3	80.51	—	—	—	—	98.24		
K-1	71.46	84.20	89.62	94.59	95.38	97.46		
Q-1	77.33	93.82	95.89	97.87	98.54	99.51		
B-1	76.56	89.69	92.26	95.51	96.83	97.76	98.37	
B-2	68.86	84.35	91.51	93.87	95.21	96.99	97.66	
D-1	75.06	88.84	92.68	94.93	96.30	96.84	97.84	
E-1	78.71	92.02	94.37	96.41	98.03	98.67	99.53	
G-1	76.50	88.86	92.69	96.50	97.64	99.04	99.25	
I-1	81.69	88.62	93.51	93.93	95.47	97.22	97.70	
L-1	75.92	86.55	90.41	91.12	94.96	96.20	98.55	
O-1	83.11	87.81	94.26	96.92	96.95	97.77	98.91	
W-1	80.46	85.76	88.24	93.95	96.32	97.73	98.97	
S-1	83.83	91.84	95.03	95.36	96.55	97.91	98.78	99.83
Average:								
1995	78.00	89.02	93.05	95.45	96.82	97.93	98.56	99.83
1994	75.03	86.76	90.88	94.25	95.81	97.58	98.03	99.25
1993	80.00	88.65	94.03	95.55	97.56	98.56	99.01	98.71

— not sampled

Table 8. Summary of 1995 Mill Tests

Factory	Pol % Cane	Fiber % Cane	Ash % Cane	Pol % Bag	Fiber % Bag	Moist % Bag	Ash % Bag	First Mill Extr.	Tandem Extr.	Reduced Extr.	Prep. Index	Last Mill % Open Cells
F-1	11.94	13.09	0.84	3.12	39.49	54.12	1.28	67.68	91.35	91.80	70.18	98.32
C-1	11.54	13.30	1.03	2.23	42.35	51.06	2.34	66.29	93.94	94.36	82.01	99.03
C-2	12.15	15.71	1.36	2.37	41.79	49.88	3.72	51.79	92.68	94.39	85.85	98.64
C-3	10.42	15.19	1.19	1.71	40.94	50.46	3.03	---	93.92	95.15	80.51	98.24
K-1	11.38	13.88	1.36	3.81	38.54	51.62	2.05	57.57	87.95	89.31	71.46	97.46
Q-1	12.89	13.92	1.05	2.75	42.77	50.70	2.14	68.82	93.06	93.87	77.33	99.51
B-1	12.00	13.10	0.99	2.26	40.52	53.91	1.42	56.96	93.91	94.23	76.56	98.37
B-2	9.68	11.41	3.44	2.11	33.52	58.22	2.89	55.43	92.59	91.78	68.86	97.66
D-1	12.52	13.19	0.80	3.49	33.87	59.84	1.04	63.77	89.13	89.78	75.06	97.84
E-1	11.82	12.25	1.27	2.28	42.66	49.31	3.35	73.43	94.46	94.33	78.71	99.53
G-1	11.31	12.60	2.25	2.42	40.91	51.08	3.48	60.21	93.40	93.46	76.50	99.25
I-1	12.72	13.68	0.89	3.77	35.00	56.76	1.27	58.10	88.44	89.58	81.69	97.70
L-1	11.56	13.35	0.96	3.52	33.19	60.53	2.32	12.88	87.74	88.63	75.92	98.55
O-1	12.73	11.67	0.70	3.10	37.06	56.37	1.16	58.16	92.35	93.46	83.11	98.91
W-1	8.68	12.91	1.70	2.54	36.07	52.58	3.83	37.39**	89.50	89.88	80.46	98.97
S-1	10.92	13.04	1.11	2.10	38.38	53.41	2.72	56.25	93.47	93.78	83.83	99.83
Average:												
1995	11.52	13.27	1.31	2.72	38.57	53.74	2.38	56.32	91.74	92.36	78.00	98.61
1994	11.82	13.30	1.06	3.43	37.11	53.21	1.76	45.09	89.34	90.08	75.03	98.12
1993	11.24	12.90	1.28	3.06	37.25	53.95	2.46	50.04	90.42	90.51	80.00	99.11

** two roll crusher
--- not sampled

Table 9. Prepared Cane and Bagasse Density Tests at St. James (12/11/95)

	Prepared Cane and Bagasse Density Tests				
	Press	Density,	Moist	Fiber	Ash
PC	0	—	73.97	13.79	2.17
Mill 1	0	—	59.67	29.44	1.87
Mill 2	0	—	57.70	29.64	2.81
Mill 3	0	—	55.74	35.00	2.47
Mill 4	0	—	57.82	35.21	2.74
Mill 5	0	—	55.98	39.51	2.27
PC	500	82.27	52.79	34.04	4.81
Mill 1	500	77.18	46.86	43.86	2.66
Mill 2	500	76.93	42.82	44.81	3.57
Mill 3	500	78.78	41.53	47.74	3.77
Mill 4	500	78.67	42.40	49.17	3.64
Mill 5	500	78.27	43.81	50.68	3.03
PC	1000	88.72	46.42	39.31	5.98
Mill 1	1000	84.29	42.09	48.05	3.68
Mill 2	1000	84.57	40.82	48.07	3.97
Mill 3	1000	86.45	38.97	51.73	3.67
Mill 4	1000	85.28	38.24	51.74	3.75
Mill 5	1000	85.77	40.08	52.98	3.13
PC	1500	90.68	43.97	42.40	6.56
Mill 1	1500	84.53	40.20	49.97	3.11
Mill 2	1500	87.36	38.23	51.26	4.80
Mill 3	1500	88.47	36.24	53.55	3.76
Mill 4	1500	88.63	38.39	54.69	3.99
Mill 5	1500	87.19	38.68	54.42	3.19
PC	2000	93.79	42.11	45.96	6.01
Mill 1	2000	86.54	39.45	51.78	2.96
Mill 2	2000	88.05	35.80	51.70	4.72
Mill 3	2000	90.10	35.92	55.04	3.65
Mill 4	2000	89.61	36.75	57.46	4.18
Mill 5	2000	88.30	38.36	56.29	3.37
PC	2500	94.89	39.89	47.03	6.50
Mill 1	2500	88.29	38.14	53.87	3.25
Mill 2	2500	90.49	35.87	53.55	4.71
Mill 3	2500	92.98	33.72	57.60	9.69
Mill 4	2500	90.27	34.59	57.70	4.46
Mill 5	2500	89.30	37.19	55.24	3.13

--- not measured

Table 10. Prepared Cane and Bagasse Density Tests on Samples From Savoie Industries.

	Prepared Cane and Bagasse Density Tests				
	Press	Density,	Moist	Fiber	Ash
PC	0	—	71.85	15.33	1.02
Mill 1	0	—	60.43	27.55	3.19
Mill 2	0	—	59.58	30.99	1.08
Mill 3	0	—	65.64	26.73	2.41
Mill 4	0	—	60.64	32.07	2.76
Mill 5	0	—	51.90	44.02	2.12
PC	300	77.54	55.50	33.83	1.65
Mill 1	300	75.96	48.66	39.65	4.03
Mill 2	300	73.75	49.42	44.25	1.32
Mill 3	300	76.96	51.04	43.03	3.41
Mill 4	300	75.91	48.82	45.06	3.70
Mill 5	300	72.93	44.25	48.30	2.54
PC	500	85.05	50.40	37.36	2.00
Mill 1	500	80.32	47.43	40.73	4.43
Mill 2	500	77.37	46.72	45.80	1.46
Mill 3	500	81.61	45.79	44.28	3.89
Mill 4	500	81.68	45.04	45.34	4.35
Mill 5	500	77.02	42.81	49.75	2.74
PC	1000	88.26	48.05	43.07	2.35
Mill 1	1000	84.73	42.18	45.30	5.08
Mill 2	1000	84.16	43.90	49.74	1.66
Mill 3	1000	87.75	41.59	47.91	5.18
Mill 4	1000	85.94	45.10	49.70	4.05
Mill 5	1000	82.25	40.23	53.10	2.87
PC	2000	90.78	41.94	48.87	2.27
Mill 1	2000	89.14	39.62	47.64	5.06
Mill 2	2000	89.46	37.77	54.33	1.67
Mill 3	2000	91.86	39.99	54.01	3.86
Mill 4	2000	90.77	38.28	53.60	4.46
Mill 5	2000	87.15	37.97	57.80	2.83
PC	2500	92.11	40.37	50.25	2.55
Mill 1	2500	89350	38.34	50.01	5.45
Mill 2	2500	90.85	38.78	54.45	1.58
Mill 3	2500	93.37	39.80	54.83	4.27
Mill 4	2500	90.36	38.16	55.36	4.27
Mill 5	2500	88.77	36.34	59.39	2.93

— not measured

ASH REDUCTION IN RAW SUGAR

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INTRODUCTION

When (sulphated) ash levels in raw sugar exceed a level set by the refinery, a financial penalty is imposed. The removal of nonsugars (ash components) during mixed juice clarification determines to a large extent the ash concentration in the raw sugar. Louisiana raw sugar factories generally apply cold liming, heating, and the addition of an anionic flocculent just before the clarifier. In the laboratory, the addition of a cationic flocculent was studied and it gave the best results if added at the 4.5ppm level before cold liming. Toward the end of the 1995 grinding season, an investigation was undertaken at a raw sugar plant, which at the time was paying a penalty for elevated ash levels.

METHODS

Midland Chemicals, cationic flocculent, PCS-3016 (MW 100,000, 100% hydrolized) was metered into the mixed juice, diluted 1:1 with water. The concentration added was 4.5ppm on mixed juice. Representative samples of clarified juice were analyzed for: zeta potential with a zeta meter 3.0; turbidity with a Hach Ration R/X Turbidimeter; conductivity with a CDM3 Conductivity Meter Radiometer/Copenhagen; pH, pol, brix, purity, and standard sulphated ash. With a Dionex Cation Detection System the ratio: P_2O_5 / (SiO_2 + Al_2O_3 + Fe_2O_3) was determined to be 0.13, indicating the juice was indeed difficult to clarify (1).

RESULTS AND DISCUSSION

Upon addition of the cationic flocculent and allowing for the standard residence time in the clarifier, samples of the clarified juice were analyzed. They showed a marked improvement in ash levels in the corresponding raw sugar.

The reduction in conductivity was small, from approximately 4050 mS/cm to 3950 mS/cm. This is to be expected because the electrical conductivity of the juice to a large extent is given by dissociated potassium and sodium salts, and to only a minor extent by calcium and magnesium salts (1).

The turbidity improved from 9.5 NTU/brix to 8.4 NTU/brix, and the clarified juice became clearer.

The zeta potential of the standard clarified juice was -26.4 mV and thus the stability characteristics of colloidal systems as given by Chen (2) indicate that the juice clarification could be improved. The addition of the cationic flocculent improved the zeta potential to -14.3 mV, reaching the threshold of reasonable agglomeration and precipitation.

The sulphated ash levels reduced sharply from 0.414% to 0.3185% upon the addition of the cationic flocculent. Over the next several days, the reduction in sulphated ash content varied between 8% and 12%.

With unsatisfactory clarifications, the application of a cationic flocculent should be considered.

REFERENCES

(1) Honig, Pieter (1953). Principles of Sugar Technology, Elsevier Publishing Company.

(2) Chen, James C.P. and Chung Chi Chou (1993). Cane Sugar Handbook, John Wiley & Sons, Inc.

DIRECT PRODUCTION OF WHITE CANE SUGAR WITH CLARIFICATION AND DECOLORIZATION MEMBRANES (*)

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During most of the 1994 crop, the ASI ceramic membrane pilot was operated on clarified juice at ASI and at a Louisiana mill and its performance measured. The processed turbidity-free juice was concentrated, refrigerated and stored until spring 1995, when the decolorization and crystallization tests were done.

DECOLORIZATION OF ULTRAFILTERED CLARIFIED JUICE

The syrup prepared from ultrafiltered juice was diluted to 15 Bx and processed in a series of 100 to 200 liter batch tests on the ASI polymeric membrane pilot, equipped with one 6 x 100 cm (2.5 x 40") spiral-wound G-10 thin-film (TFM) membrane (Desalination Membrane Products, Escondido, CA), with 2,500 MWCO (molecular weight cut-off) and a surface area of 3.5 m^2 (38 ft^2, Table 1). Although the membrane can tolerate temperatures up to 90°C (194 °F), in preliminary tests the color rejection was found lowered with increasing temperature. At the same time, increasing the transmembrane pressure did not negatively affect the product color. The high end of the recommended operating pressure (400 psi) was therefore used later in a series of tests of the membrane performance.

Depending on the temperature, the filtration flow rate starts between 25 and 45 $l/m^2/hr$ (15 to 27 $gal/ft^2/day$, VCF = 1), and reaches 10 to 15 $l/m^2/hr$ (6 to 9 $gal/ft^2/day$) at VCF 10. For the middle of the temperature range (65 °C, 175° F), which is apparently the maximum temperature for this membrane to still give a syrup that can be boiled to a white sugar product, an average flow rate of 20 to 25 $l/m^2/hr$ (12 to 15 $gal/ft^2/day$) is realistic for the design. With increasing VCF (and time), the colorants (and to a lesser degree all non-water components) get concentrated in the feed tank, the Brix reaches close to 30, and the color of the product increases as well. The color removal (1 - color of permeate/color of feed) though increases also, as the average molecular size of the colorants in the feed increases with VCF.

First indications are that cleaning of the decolorization membranes with dilute caustic solutions is easy and is required only infrequently. No cleaning was done between individual batch tests, only before a longer shut down, thorough flushing with water was done, followed by cleaning with 0.1 % caustic soda and sanitizing with a formaldehyde solution.

(*) Abbreviated from: Sugar Journal, November 1995, p. 19 - 21, and December 1995, p. 29 - 31.

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CRYSTALLIZATION OF TREATED LIQUORS

The laboratory crystallization tests (Table 2) were done identically in each case with a) conventional syrup, b) syrup (UF) from juice clarified with ceramic ultrafiltration membranes, and c) a syrup (UF/NF) prepared from juice that was first ultrafiltered and then partially decolorized with the polymeric membrane as described in the previous section. The 60 Bx syrup (600 ml) was concentrated under vacuum (at ~ 50°C, 148 °F) to 73 Bx, seeded with 4 g of 0.25 - 0.50 mm fine refined sugar, and crystallized for 4 to 5 hours, in motion (rotovap), under vacuum at an evaporation rate of 13 to 18 ml/h. The crystals were then separated, with no washing, in a laboratory centrifuge (20 min, ~ 3000 RPM, ~ 600 G). To wash (affine) the crystals, a part of the unwashed sugar was mingled (15 min) at ambient temperature with a saturated solution of refined sugar and recentrifuged for 10 minutes as before.

As a control, in order to validate the laboratory techniques, a conventional syrup (no membrane treatment) prepared from the same clarified juice as used for the membrane treatment was crystallized. The sugar color obtained was 2,200, and when washed 1,100 IU color, similar as in the industrial practice. Sugar from liquors treated with ceramic membranes (UF) averaged 1,200 and 290 IU, respectively. The average estimate of the white sugar (UF/NF) quality is a conservative one: for one, the decolorization (nanofiltration) tests involved a range of conditions, many at less than optimum temperature in terms of color removal. Furthermore, a significant color increase of up to 1,000 IU occured in concentrating some batches of the UF/NF juice in the ASI pilot evaporator. Nevertheless, the color of the UF/NF washed sugars averaged 46 IU, with an estimate of 25 IU washed sugar color when the decolorization is done at 28 bar (400 psi) and 65°C (121° F).

The color transfer (ratio of sugar/liquor color) is clearly higher for the conventional syrups. Although the slope of the correlations is nearly identical, the effective color transfer for the UF/NF syrups is only 30% to 40 % of those found for South African refinery liquors decolorized with carbonatation and ion exchange. A refinery fine liquor of 600 to 800 IU color, decolorized with combination of carbonatation, carbon and/or ion exchange, is required for affined color of 25 IU, while the same product color can apparently be produced from cane liquors of 3,000 IU color decolorized with membranes. The membrane-treated cane syrups do, in that respect, behave rather as beet syrups where the syrup color/sugar color ratio is on the order of 120. Although not yet measured, the removal of proteins and polysaccharides with nanofiltration membranes is expected to be absolute, producing a uniform product, regardless of the fluctuations of the cane quality.

TABLE 1: Properties and operating parameters of the G-10 thin-film nanofiltration elements (Desalination Systems Inc., Escondido, California).

MOLECULAR WEIGHT CUTOFF	2,500
TYPICAL OPERATING PRESSURE	5 - 28 bar 70 - 400 psi
MAXIMUM PRESSURE	41 bar 600 psi
TEMPERATURE	90 °C 194 °F
pH, OPERATION	2 - 11
pH, CLEANING	2 - 11.5
CHLORINE TOLERANCE	20-50 ppm-days
REJECTION, %	
SODIUM CHLORIDE	10
SUCROSE	50
DEXTRAN, < 1,000 Mw	90
DEXTRAN, 1,500 Mw	95

TABLE 2: Properties of the conventional syrups, ultrafiltered (UF) syrups and those decolorized with nanofiltration membranes (UF/NF) (Line 1), and unwashed (Line 2) and washed (Line 3) sugars produced from them in the laboratory crystallization tests.

		CONVENTIONAL			UF			UF/NF		
		min	max	average	min	max	average	min	max	average
COLOR IU	1	12,300	16,200	14,200	11,500	16,800	14,300	2,360	5,500	3,590
	2	1,520	3,120	2,160	773	1,650	1,170	91	564	304
	3	607	1,680	1,060	130	485	294	15	119	46
ASH %	2	0.21	0.28	0.24	0.19	0.52	0.27	0.083	0.26	0.18
	3	0.049	0.078	0.047	0.017	0.021	0.019	0.006	0.016	0.012
INVERT %	2	0.20	0.23	0.21	0.16	0.40	0.21	0.18	0.33	0.25
	3	0.035	0.055	0.045	0.019	0.04	0.028	0.02	0.042	0.028

CLARIFICATION MONITORING

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Clarifier operation is not routinely monitored in a sugar factory. Yet clarifier efficiency underlies much of the work done on the pan floor. The role of clarification, after increasing pH to prevent inversion, is to remove the suspended matter, leaving the juice as free of sediment as possible prior to evaporation. If the sediment is not removed, the suspended matter causes scaling in the evaporators and pans, interferes with purging of the centrifugal, and contributes to high ash and low quality sugar. Maximizing clarifier operation is an area given little attention in most sugar factories due to the absence of adequate tools for monitoring clarifier functioning. Clarification efficiency is normally monitored by visually determining the clarity of the juice. A clear juice is an indication of a sharp and rapid precipitation with good coagulation of coarse suspended matter. It usually means that there are relatively small amounts of protective colloids present (1). Deteriorated juices never give clear juice. Applying a turbidity correction to spectrophotometer readings makes possible the use of this instrument for monitoring sediment in clarified juices.

Spectrophotometry is normally used to measure color in solutions free of suspended particles, so that light absorption is due only to the compound to be measured. However, concentrations of suspended particles may be estimated spectrophotometrically provided the suspensions are sufficiently stable that overt settling does not occur during the time of measurement. then the diminution of light intensity becomes a measure of turbidity. However, the turbidity readings rapidly diverge from linearity with increasing

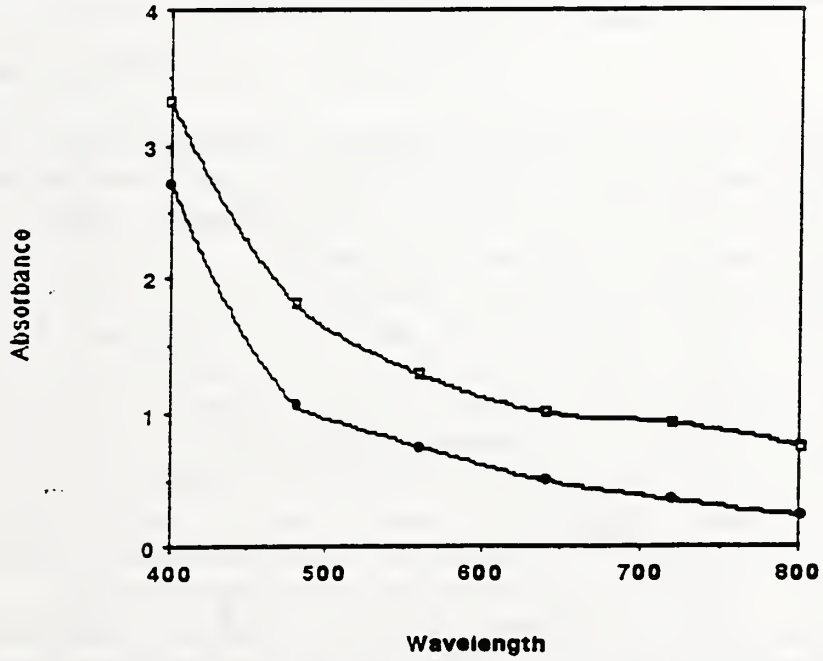

Figure 1. A typical wavelength of a Louisiana sugar factory clarified juice (□) and the same clarified juice after high speed centrifugation (•). The difference between the two lines is a measure of light scatter caused by sediment in the juice.

sediment such that readings above 0.3 absorbency are not linear with concentration. It is common practice in the field of microbiology to correct these values using a correction table. This expands the range where measurements may be made without dilution, to absorbance readings above 1.0. We have applied the same principle to the measurement of turbidity in clarified juices. A wavelength was chosen (610 nm) that is readily reached by most sugar factory laboratory spectrophotometers, yet minimizes absorbance due to color in clarified juice. This was determined from the scan of absorbance versus wavelength of a factory clarified juice and the same juice with the residual turbidity removed by high speed centrifugation. As is obvious from Figure 1, color absorption decreases with wavelength; the higher the wavelength the lower the background color. The chosen wavelength was a compromise as many factory instruments will not read above 700 nm. It is in a region where a small change in wavelength does not result in a large change in absorbance, minimizing error in instrument calibration.

Clarified juice samples were obtained from various sugar factories in Louisiana, the turbidity determined, and then the sediment was removed by high speed centrifugation, collected and dried to constant weight. As was expected a linear relationship was found between corrected spectrophotometer readings and sediment, while the relationship was non-linear if absorbance corrections were not made (Fig 2). Corrections to absorbance values were made using the relationship given by Toennies and Gallant (2) where AOD = 1800-100(321.33-0.3333 NOD)$^{1/2}$.

AOD is the corrected absorbance and NOD the instrument reading x 1000.
A table of absorbance versus corrected absorbance values will be supplied to Louisiana sugar factories upon request. An AOD value of 1.0 was equivalent to the presence of 0.352 mg/ml of sediment in clarified juice (or 0.0237 lbs/gal of juice).

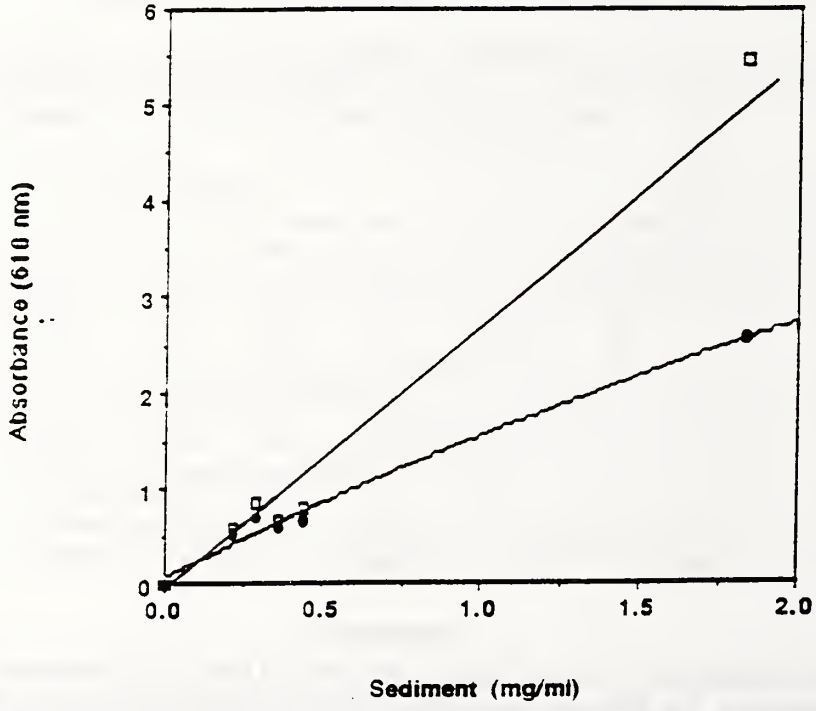

Figure 2. Absorbance (□) and corrected absorbance (•) versus centrifugal sediment - dry weight for five clarified juices from Louisiana sugar factories.

The absorbance reading on a turbid sample is both a function of the amount of sediment and the amount of color present in the sample. Because the color of clarified juice is a function of pH, and clarified juice pH varies, it is necessary to correct values to a constant pH in order to compare different juice samples. There was a linear relationship between pH and color over the range of pH values maintained in clarified juice at Louisiana sugar factories (Fig 3). From this relationship a value of +/-0.0149 corrected absorbance units / 0.1 change in pH was determined.

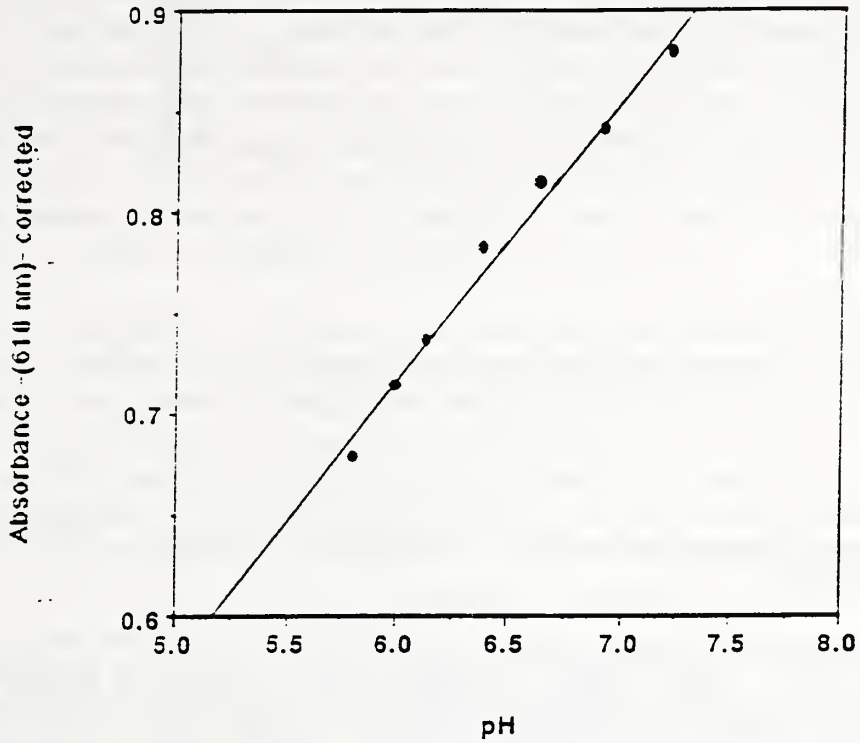

Figure 3. Change in absorbance at 610 nm in clarified juice as a function of juice pH.

Using a spectrophotometer it is possible to monitor sediment in clarified juice with time, giving a picture of how a factory clarifier is operating. Typically the following manipulations are necessary. First a spectrophotometer reading on the clarified juice at 610 nm is obtained. Normally a 1 cm cell is used. This value is converted to AOD using either the formula or a correction table. The AOD is then adjusted to a constant pH value by adding or subtracting the pH correction factor times the amount the pH (0.1 unit intervals) varies from the desired operating value. For example, the clarifier is set to operate at pH 6.6. A sample is taken of clarified juice; it has a pH of 6.4 and gives a reading at 610 nm of 0.653. The NOD (0.653) is corrected to an AOD of 0.782 and then is adjusted for a pH of 6.6 by adding 2 x 0.0149 to the AOD value, given a final AOD of 0.812. This is converted to mg/ml of sediment (0.286 mg.ml; or 0.0192 lbs/gal). Given the scale of clarification operations, this can indicate a significant amount of insolubles going to the evaporators, in this example 19.2 lbs/1000 gallons.

This procedure was tested at five Louisiana sugar factories during the 1995 sugar processing season and a detailed analysis of these results will be presented in another forum. However, it is obvious that this test provides a simple measure for the operating state of the clarification system in a sugar factory. A typical daily report from a Louisiana factory is shown in Fig 4.

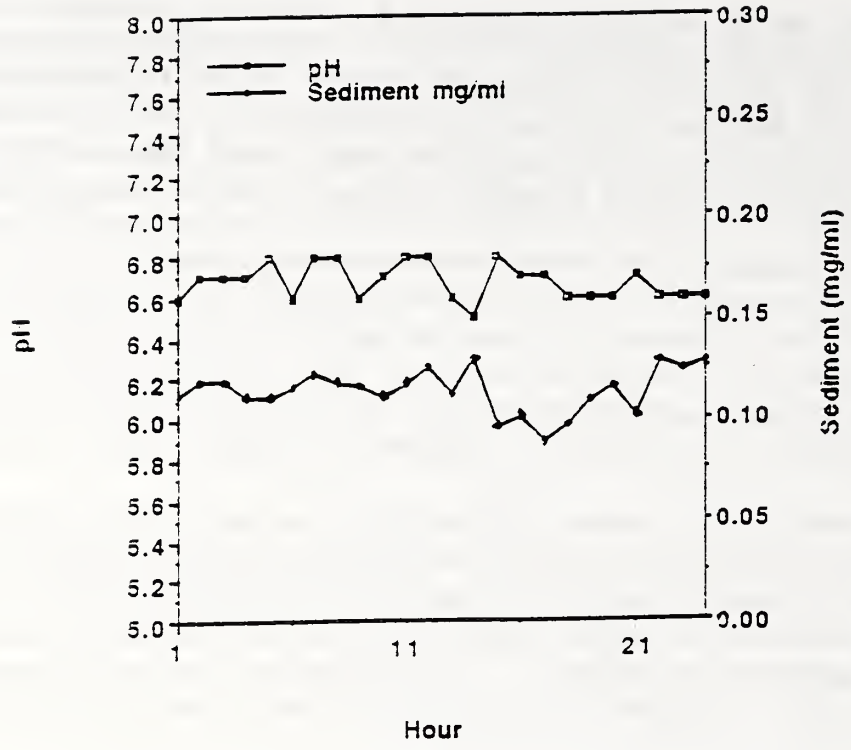

Figure 4. A daily clarifier sediment profile from a Louisiana sugar factory showing pH (□) and sediment (•) changes during a 24 hour period.

This simple analytical procedure can be used to provide a daily record of sediment passing to the evaporators. High levels of sediment are a warning of problems in the clarification, potentially shortened times before boil out of the evaporators or deteriorated cane. This method can be used to provide the clarifier operator a rapid check on the quality of the clarified juice being produced, allowing real time operator control, as well as providing the manager with an indication of developing problems at an early stage in sugar manufacture.

Summary Calculation

1. Convert AOD to NOD.

2. mg/ml sediment = [NOD +/- (0.0142 n)] x 0.352

n = the difference in 0.1 units from clarifier set point pH; add the correction if observed pH is below set point value, subtract if it is above.

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TEXTILES FROM BAGASSE

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This project is a continuation of work to develop value-added products from sugarcane and other plant stalk fibers. Previous research demonstrated that rind mechanically separated from the sugarcane stalk could be chemically treated to extract cellulosic fibers. Prototype nonwoven mats for soil erosion control were produced and tested, initial work on carding fibers was concluded, and preliminary investigations of composites usage are progressing. Two steps in the process for producing erosion control mats have been eliminated, Tilby processing and steam explosion. It appears to be possible to use bagasse as the source, to process at atmospheric conditions, and discharge directly to form a mat.

PROGRESS REPORT: A process, for which a patent application is pending, has been developed to produce textile products from sugarcane. Demonstration of this process has been accomplished using the rind of sugarcane, obtained by splitting the cane and routing out the core in a Tilby type of process, followed by an optional steam explosion step. The 200 L reactor used in this effort was manufactured by Cameco, with ASCL funding for the reactor and some of the personnel costs. Additional funding has been provided through grants from: the Louisiana Education Quality Support Fund (LEQSF), USDA National Research Initiative Competitive Grant Program, and the Louisiana Transportation Research Center (LTRC).

During this past year, erosion control mats have been field tested in cooperation with LTRC, and the process has been simplified and adapted to use with bagasse as the starting material. During the late spring and summer a field test was conducted at the Millerville exit of I-12 in Baton Rouge. The sugarcane erosion control mats were tested and compared to the following commercial erosion control products: stitched straw, stitched excelsior (wood strips), stitched coconut, woven coconut, and spray-on wood fibers. The sugar cane mats were equivalent to or better than all of the commercial materials. The spray-on product was washed away in a heavy rain 8 hours after application and was reapplied two weeks later, but the other products remained. All of the stitched and woven products became taut after the rain and heat, but the sugarcane mats conformed to the contours of the soil and prevented undercutting. All of the products promoted grass propagation as desired. However the sugarcane mats excelled in another fashion also. When the slope was inadvertently partially mowed twice during the test and then afterwards, the sugar cane mats were unaffected, but the woven product and the stitching of the other commercial mats were caught occasionally by the mower and the mats ripped in spots from the slope.

The development of the sugarcane erosion control mats has been chosen by the Louisiana Engineering Society for the James M. Todd Technological Accomplishment Award for 1995. The Award is presented to an engineer (the PI of this proposal) by this state society of the National Society of Professional Engineers for distinguished service in the field of technological advancement or discoveries. Only one award is made annually, and this project was the unanimous choice for 1995.

Another aspect of the ongoing research has been process simplification. By adjustment of the processing conditions, it has been possible to modify the process so that bagasse can be the raw material and the delignification done at atmospheric pressure without steam explosion as a final step. Bagasse from three mills, varying in age from fresh to two year old, was used and all produced what appear to be acceptable erosion control mats. For this modification, the bagasse is first sifted, and the larger pieces (approximately half of the starting material) is partially delignified at atmospheric pressure in the reactor. A design based upon all of the process simplification for a continuous, atmospheric reactor has been developed and bid for manufacture. The only bid, from Cameco, was for $18,000, much below the actual cost but unfortunately more than the $10,000 grant awarded by ASCL last year for construction of the reactor and mat forming system ($20,000 was requested). Although other grants related to sugarcane and related plants are active, the reactor is not part of any of them and therefore the reactor has not yet been manufactured.

Based upon the results to date and assuming the use of a continuous atmospheric reactor, the following preliminary process economics have been developed. An appropriate scale for commercial production of erosion control products would use about 30% of the excess at a typical Louisiana sugar mill that processes 250 to 300 tons of cane per hour in a 90-day season. Using that estimate, the cost of producing 7.5 million square yards per year of erosion control blankets (about 5% of the current usage) would be approximately 12 cents per square yard (assuming a weight of 1 pound per square yard). After considerable cost cutting, the current price for commercial mats is 60 cents per square yard. The cost of sugarcane mats is based on a daily production of 15 tons per day of mat material for 250 production days a year. The bagasse to be converted to mats is first sifted, with roughly half becoming mats. Even though this represents only a fraction of the excess bagasse, the cost of the Btu equivalent in natural gas, $17 per ton of bagasse, is included in this cost estimate as are operating costs of $788,500 and the necessary $350,000 in capital equipment, depreciated over a five-year period.

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